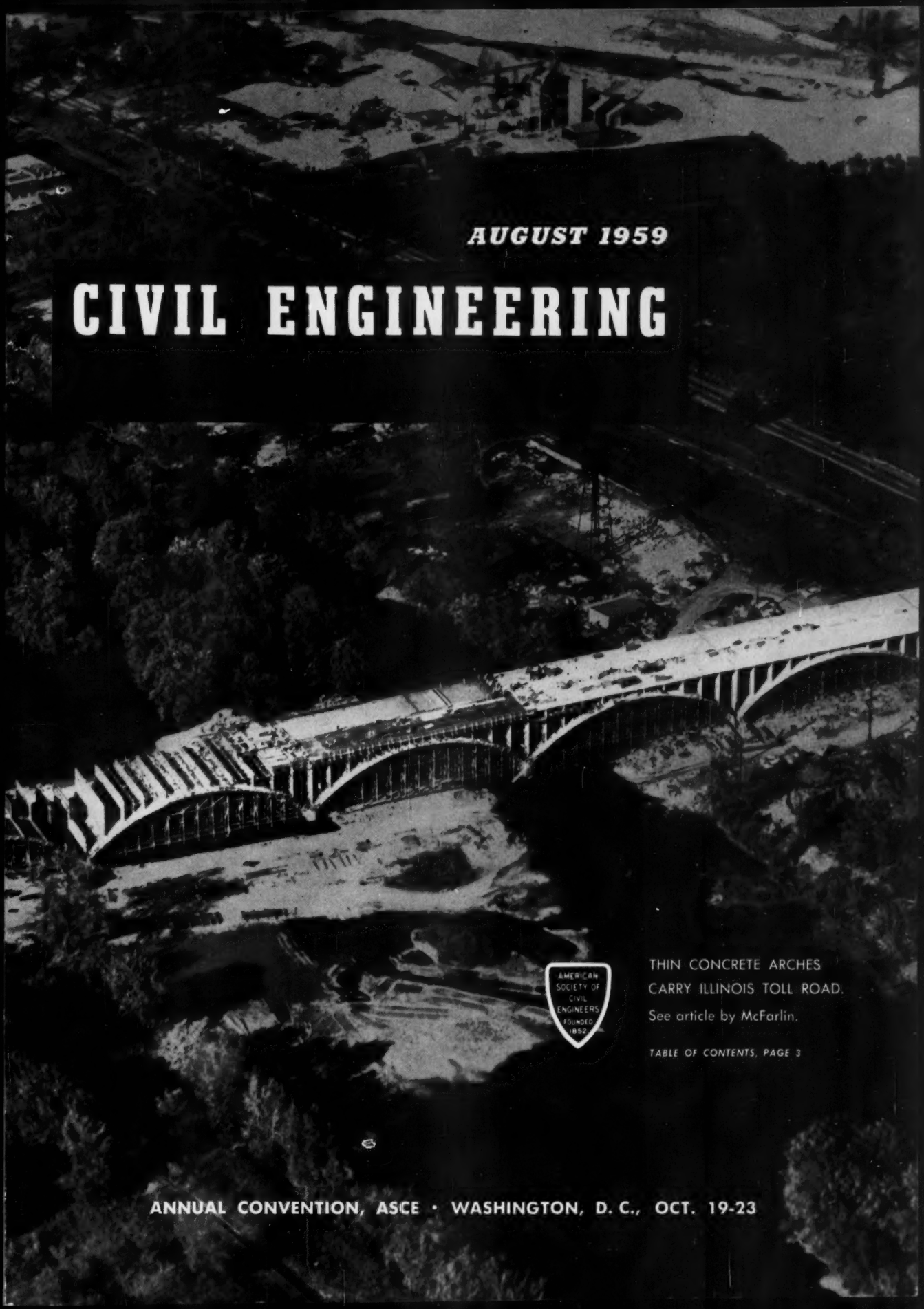

AUGUST 1959

CIVIL ENGINEERING

THIN CONCRETE ARCHES CARRY ILLINOIS TOLL ROAD.
See article by McFarlin.

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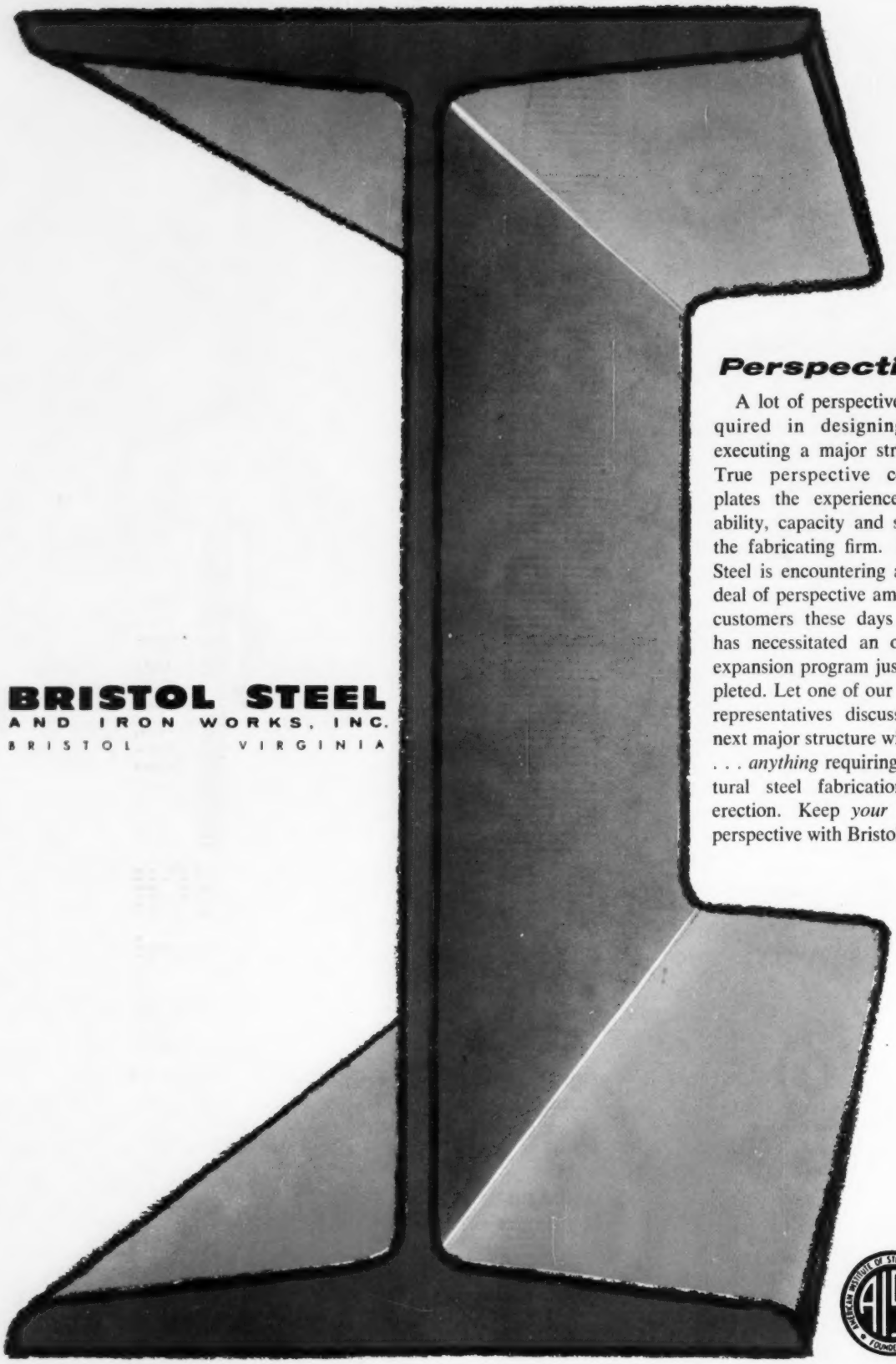

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AND IRON WORKS, INC.
BRISTOL VIRGINIA

Perspective

A lot of perspective is required in designing and executing a major structure. True perspective contemplates the experience, reliability, capacity and skill of the fabricating firm. Bristol Steel is encountering a great deal of perspective among its customers these days which has necessitated an over-all expansion program just completed. Let one of our skilled representatives discuss your next major structure with you . . . *anything* requiring structural steel fabrication and erection. Keep *your job* in perspective with Bristol Steel!

AISC
AMERICAN INSTITUTE OF STEEL CONSTRUCTION INC.
FOUNDED 1921

DEPENDABLE STRUCTURAL STEEL SERVICE SINCE 1908!

Owner: Harris Trust and Savings Bank, Chicago, Ill.

Architects&Engineers: Skidmore, Owings & Merrill, Chicago, Ill.

General Contractors: Turner Construction Company.

FOUNDATION FOR CHICAGO SKYSCRAPER

Drilled-In Caissons carry load to rock without loss of ground

This foundation—for Harris Trust and Savings Bank's new 23-story addition—illustrates the special features of the Drilled-In Caisson method, used here for the first time for a large downtown Chicago building.

On a site surrounded by existing structures, Drilled-In Caissons were installed through lenses of running sand and seated in bedrock at a 111-ft. depth—without disturbance of the foundations of adjacent buildings.

The sheeting and bracing system, pictured above, is similar to the one we had previously installed for the foundation of the nearby Inland Steel Building.

There was no division of responsibility on this project. Spencer, White & Prentis did the excavation, sheeting, bracing and caissons under one contract. Despite a tight schedule set by the General Contractor, the work was completed on time.

CATALOG ON REQUEST

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48,800 copies of this issue printed

CIVIL ENGINEERING

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Reader's

Oh, what will you do without water?

America is using 167 million gallons of water a minute!

Demand increases by the hour. By the time today's toddlers are grown, we'll need *twice* as much water.

Where will it all come from? Will you have enough? You'll find the answer below . . .

Now, what can you do about water?

This free booklet, "*WATER—make sure you'll always have plenty,*" tells how to learn if you're running short, what to do if you are. Write Cast Iron Pipe Research Assn., Prudential Plaza, Chicago 1, Ill.

Printed in your interest by the makers of America's greatest water carrier . . .

CAST IRON PIPE

New Ad Campaign in Reader's Digest Dramatizes America's Water Problem

Cast Iron Pipe Research Association promotes better understanding of water supply and distribution problems

Offers Informative Booklet for Step-by-Step Action at the Local Level

Here's help for consulting engineers and everyone else directly concerned with the supply, treatment and distribution of water—help that will acquaint the general public and community leaders with the vital importance of this growing problem.

On the opposite page you see the first in a series of advertisements, this one appearing in February *Reader's Digest*. Placed by the Cast Iron Pipe Research Association, these striking advertisements point out to Mr. and Mrs. America how much we depend on a good water system and why we can no longer take it for granted.

Similar advertising will appear regularly this year in *U. S. News & World Report*, *Nation's Business*, *Better Homes & Gardens*, *American Home* and *Sunset* magazines to carry this public service message to millions of community leaders and homeowners.

Free Local Plan-of-Action Booklet

These ads offer a free booklet telling about the water problem. It shows how responsible citizens can acquaint themselves with the needs of their community. It also gives a step-by-step outline of action, telling how they can help their officials extend and improve the local water system through more adequate rate structures or financing.

We'll be happy to send you a free copy of this new booklet. Write to Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Ill.

THREE REASONS WHY CAST IRON PIPE IS *AMERICA'S GREATEST WATER CARRIER:*

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THE MARK OF THE 100-YEAR PIPE

Two Gurley transits feature built-in optical plummets

Gurley OP-57

Gurley OP-137

The Gurley Optical Plummet Transit (Model OP-57) has proved itself to be such an important time and money saver in the field that this optical plummet feature has also been added to the Model 132 Standard Precise Transit. The new transit will be known as the OP-137.

Both these Optical Plummet Transits will save you time and trouble in setting over a point. The OP-57 and OP-137 eliminate the swing and sway of the cord and plummet—exasperating and time consuming. You will especially appreciate the increased accuracy on windy locations.

By rotating the instrument 180°, you can be assured of positive centering.

The Gurley Optical Plummet Transits are furnished with tripods which have built-in shifting heads. They allow a two-inch shift of instrument over the point, providing greater latitude in initial set-up.

Model OP-57 is recommended for very exacting work; the OP-137 for general engineering and construction work because of its shorter telescope, smaller size and its lighter weight.

Now in *two* models Gurley offers you an important advantage of the optical-reading theodolite *plus* the simplicity, ruggedness and proved performance of the American transit. *Write for new Bulletin OP-100.*

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Engineering Instruments Division

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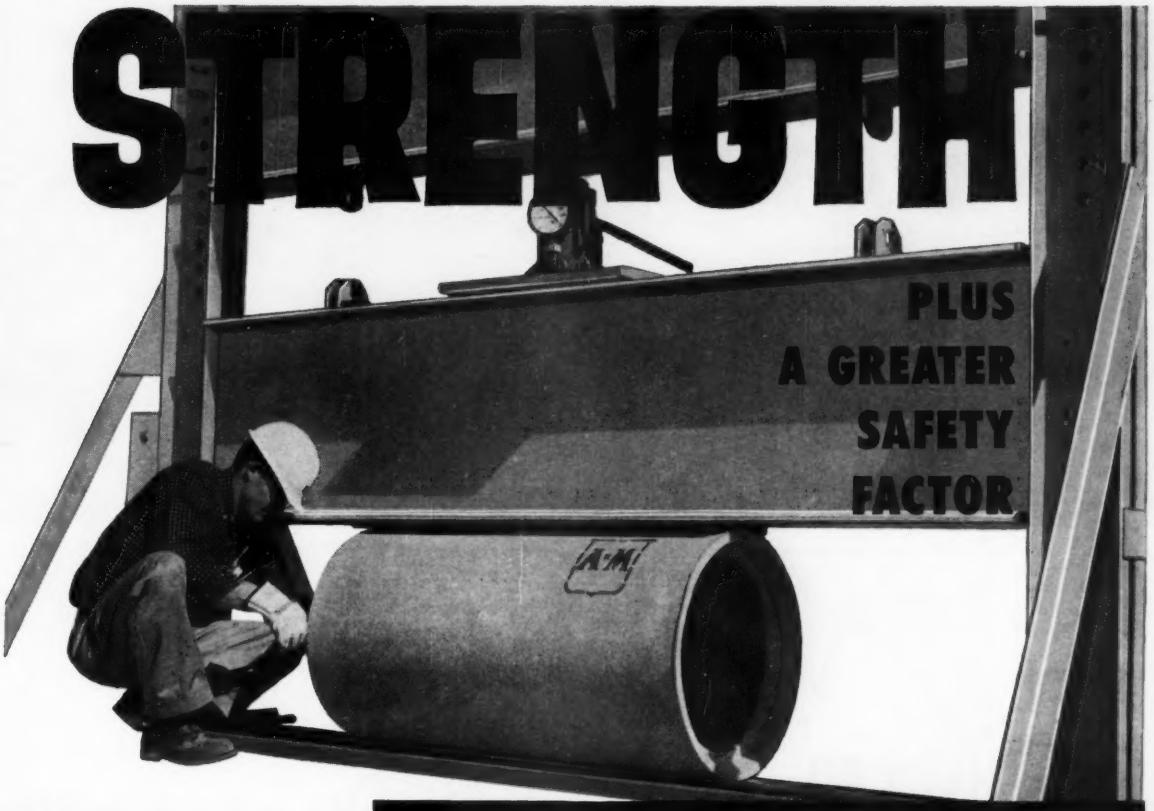
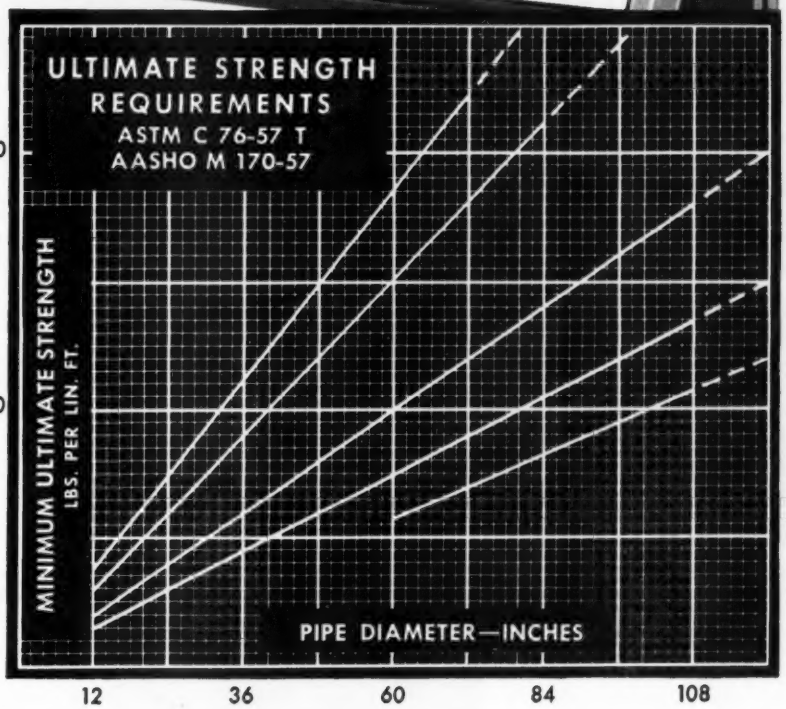


COMPARE THESE CONCRETE PIPE STRENGTHS WITH ANY OTHER

All classes of reinforced concrete pipe for greater strength and safety factor —as well as standard and extra strength non-reinforced concrete pipe— are available from American-Marietta Company to meet ASTM, AASHO and Federal Specifications.



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AMERICAN-MARIETTA BUILDING
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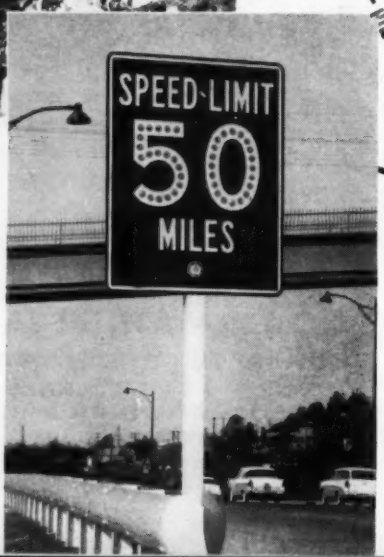
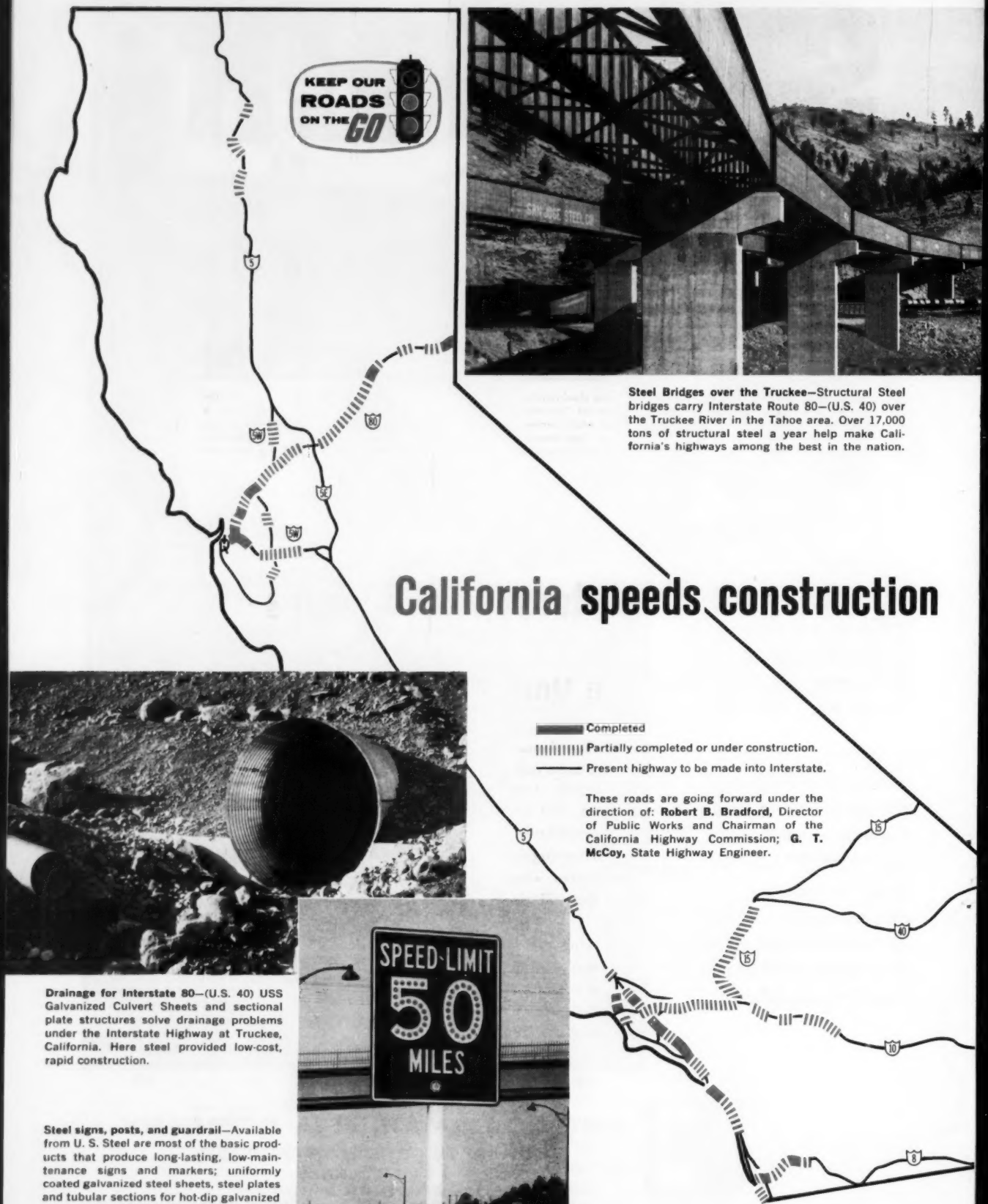
Steel Bridges over the Truckee—Structural Steel bridges carry Interstate Route 80—(U.S. 40) over the Truckee River in the Tahoe area. Over 17,000 tons of structural steel a year help make California's highways among the best in the nation.

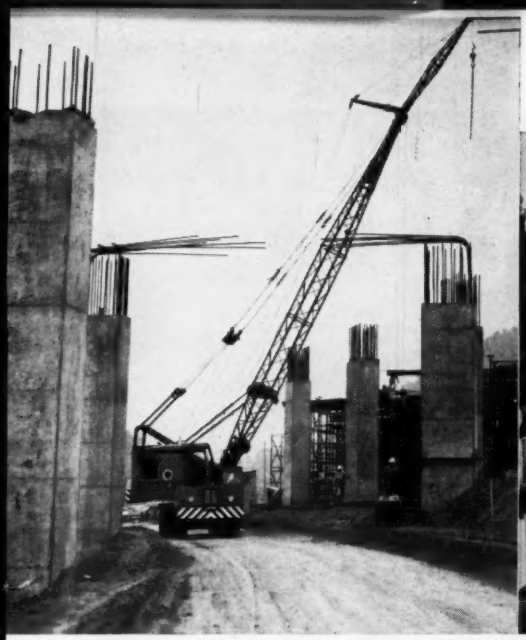
California speeds construction

Drainage for Interstate 80—(U.S. 40) USS Galvanized Culvert Sheets and sectional plate structures solve drainage problems under the Interstate Highway at Truckee, California. Here steel provided low-cost, rapid construction.

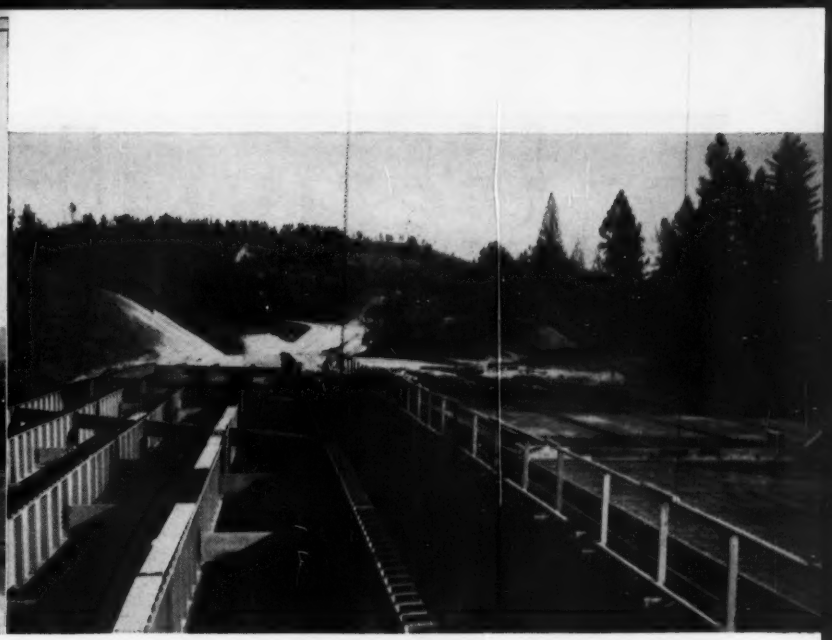


Steel signs, posts, and guardrail—Available from U. S. Steel are most of the basic products that produce long-lasting, low-maintenance signs and markers; uniformly coated galvanized steel sheets, steel plates and tubular sections for hot-dip galvanized posts, poles, and supports; USS *Vitrenamel* Sheets for porcelain enameled signs. Also shown here is USS *Western* Guardrail on the San Bernardino Freeway, Los Angeles.


Completed
Partially completed or under construction.
Present highway to be made into Interstate.
These roads are going forward under the direction of: Robert B. Bradford, Director of Public Works and Chairman of the California Highway Commission; G. T. McCoy, State Highway Engineer.



Overpass at Albany—Steel girders will be placed on top of these steel-reinforced concrete columns to form an overpass at Albany, California. USS *Di-Lok* Concrete Reinforcing Bars are used for all types of concrete work; and Universal Atlas Cement Division of United States Steel, offers a wide variety of portland cements. *Tiger Brand* Wire Rope is used in cranes, pavers, shovels, ditchers, trenchers, derricks, mixers and road scrapers.



Steel Bridges at Magra—The USS *Di-Lok* Bars in the right-hand side of these bridges at Magra near Gold Run, California, are ready for concrete. The next step in the construction of the left-hand bridge is to place the decking on top of the continuous girder span.

# of 2,194 miles of Interstate Highways

with products from United States Steel

CALIFORNIA'S HIGHWAY COMMISSION has planned 2,194 miles of Interstate Highways to be completed by 1975. 1,453 miles have already been located; 73 miles have been completed, and 170 miles are under construction. Several hundred miles of California's own Freeways are near to meeting the rigid requirements for the Interstate System; when they do, the number of *completed* miles will rise rapidly.

Steel is high on the list of products being used to speed construction on the eighteen highways in California's Interstate System: 3,186 bridges, overpasses, underpasses, and traffic-controlling clover-leafs will be built; 123 bridges are already completed and 194 are now under construction.

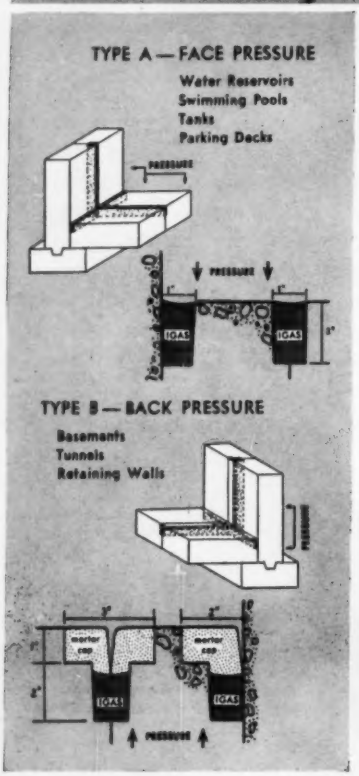
United States Steel supplies a complete line of products for highway construction: Structural carbon steel and special high-strength and constructional alloy steels for bridges; steel H-piles, sheet piling and tubular piles for bridge foundations; drainage products; reinforcing bars, welded wire fabric, cements, slag and other pavement construction products; wire rope, cable, tubing and special steels, and steel products for construction equipment; and a complete range of items including fence, beam and cable guardrail, steel for signs, markers, and other accessories. Write for the *free* 54-page booklet, "Keep Our Roads on the Go." This booklet lists all the products and services available from United States Steel to help you cut costs and speed operations in every phase of highway construction. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS and trademarks in italics are registered by U. S. Steel

USS United States Steel

The highway market is served by the following divisions of United States Steel: American Bridge Division, Pittsburgh, Pa. • American Steel & Wire Division and Cyclone Fence Department, Cleveland, Ohio • Columbia-Geneva Steel Division, San Francisco, Calif. • Consolidated Western Steel Division, Los Angeles, Calif. National Tube Division, Pittsburgh, Pa. • Tennessee Coal & Iron Division, Fairfield, Alabama • Universal Atlas Cement Division, New York • United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.

EFFECTIVELY SEALED



...with IGAS Joint Sealer

Vertical, horizontal and overhead joints are effectively sealed with Igas . . . It is self-welding, forms a continuous watertight seal . . . Intersecting joints can be sealed easily . . . Igas is a tough, resilient and non-meltable black mastic compound, adhering to any construction material . . . It remains flexible over a wide temperature range — does not sag or flow in hot weather, nor become brittle in cold . . . It will not dry out, shrink or lose its effectiveness even after years of exposure . . . Igas is non-toxic and will not affect drinking water . . . It is resistant to sewage, salts, non-oxidizing acids, dilute acids and sea water . . . Write for bulletin IS-56. For detailed recommendations on sealing joints contact our Technical Service Department.

IGAS *is available in 4 consistencies to fit your job — pressure grade • knife grade • gun grade • extrusion grade . . . also available in gray color, in gun grade and knife grade.*

26-31

SIKA CHEMICAL CORPORATION
PASSAIC · NEW JERSEY
COMPOUNDS FOR MASONRY and CONCRETE CONSTRUCTION

DISTRICT OFFICES: ATLANTA • BOSTON • CHICAGO • DALLAS • DETROIT • PHILADELPHIA
PITTSBURGH • SALT LAKE CITY — DEALERS IN PRINCIPAL CITIES — AFFILIATES AROUND THE WORLD

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Start With the Right Foundation...

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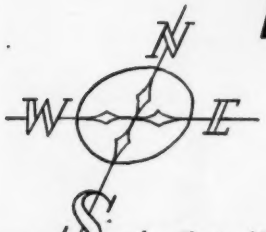
by C.L. GUILD



South – East – North – West wherever you go, you see more and more structures –bridges, piers, buildings, highways, over water and on land–being built on piles driven by the nationally organized C. L. Guild Construction Company. Specialists in the use of Cobi Piles, Guild Construction teams are experts in driving any type of pile, anywhere, at any time.

And Guild engineers, trained by experience on hundreds of the biggest construction jobs in the country, will gladly confer with you on your pile driving problems. Their experience can help you!

Before and after: the new Mall Parking Terrace in downtown Providence, R. I.

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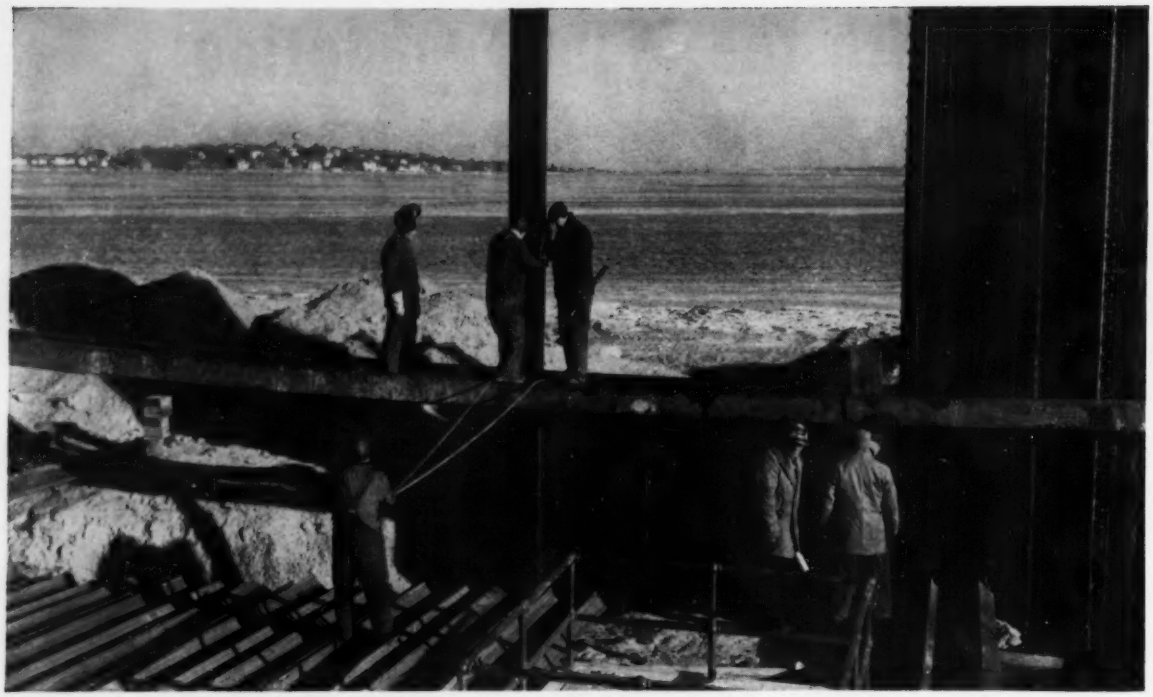
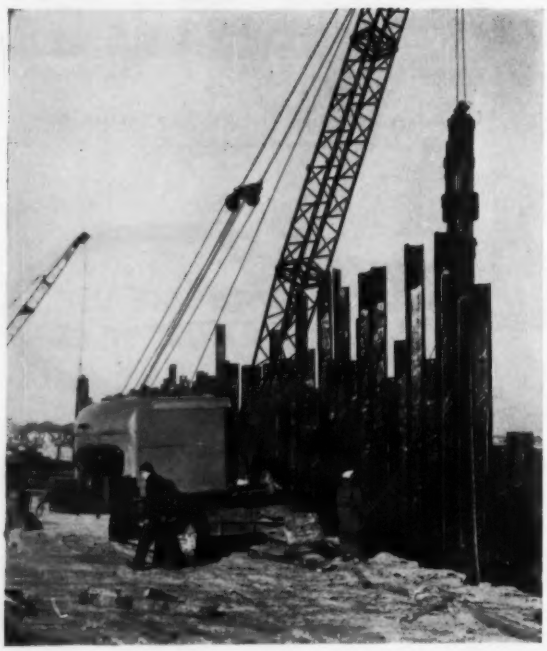
SYRACUSE, NEW YORK ATLANTA, GEORGIA KANSAS CITY, MO.



The Wollaston Beach sea wall, a Metropolitan District Commission project, was designed by Hayden, Harding, & Buchanan of Boston. Steelwork was handled by J. F. White Contracting Co., sub-contractor under Salah and Pecci Construction Co., Boston.

Mile-long sea wall of steel piling protects Massachusetts beach



A new mile-long sea wall at Wollaston Beach, bordering the bay at Quincy, Mass., protects the shore from high water, and also provides a wide bathing beach.

Some 2,900 tons of Bethlehem steel sheet piling form the wall's core. Strengthened at 15-ft intervals by structural steel buttresses, the piling was driven to resistance on bedrock. Pile lengths varied from 19 to 43 ft. The wall was then capped by nine ft. of concrete, five ft of which are below sand level to protect against beach erosion. The sea wall is approximately three ft above the roadway of Morrissey Boulevard which skirts the bay, but is four ft higher than the sand level of the beach.

Complete catalogs are yours for the asking—describing both sheet piling and H-piles. Our nearest sales office will gladly mail you one or both, or provide other data you may need.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

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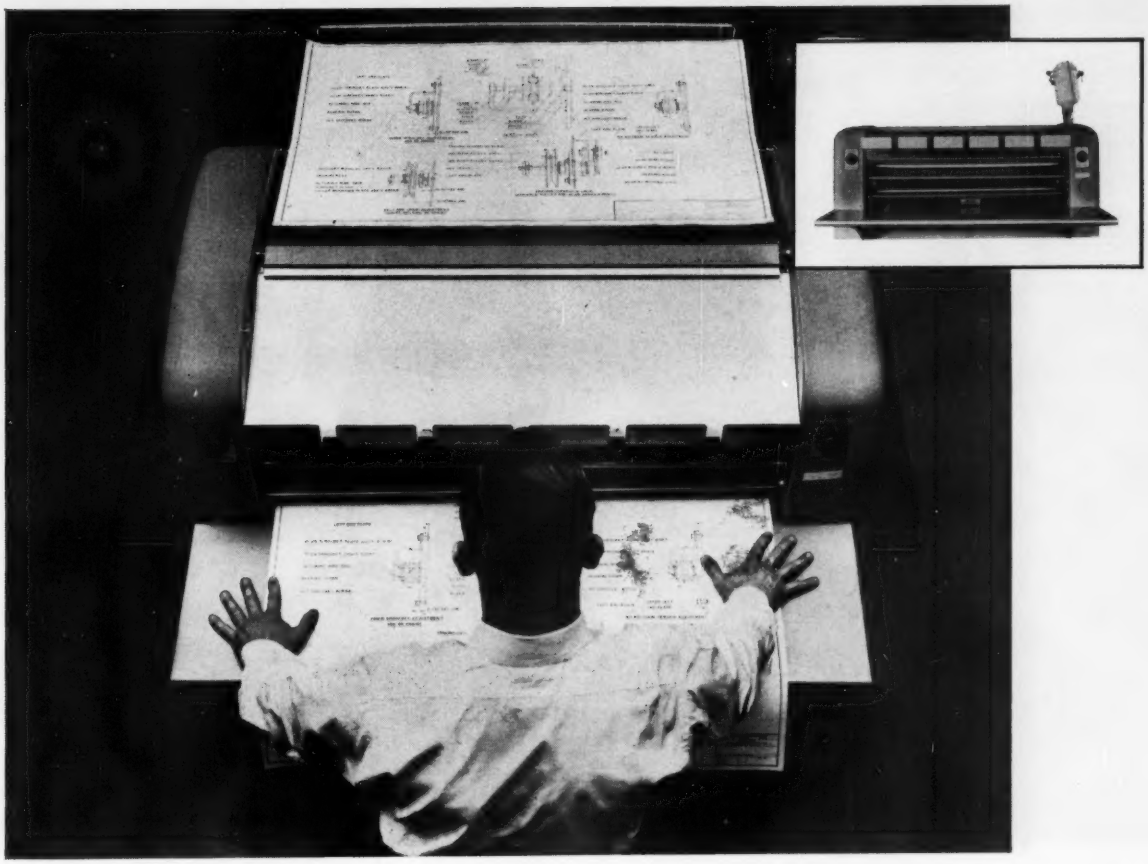
BETHLEHEM STEEL

BETHLEHEM STEEL



Announcing...
Ozalid's new 30-inch
STREAMLINER 100

Now you can have a compact table-top whiteprinter with "big machine" features at a slim-budget price. And you can enjoy the convenience of on-the-spot printmaking round the clock. Make all the prints you need, inexpensively and without delay. There's no make-ready or cleanup . . . anyone can learn to use the 100 in minutes. Check these important features:

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Please send me free descriptive brochure on the new Streamliner 100.

Name_____

Company_____

Position_____

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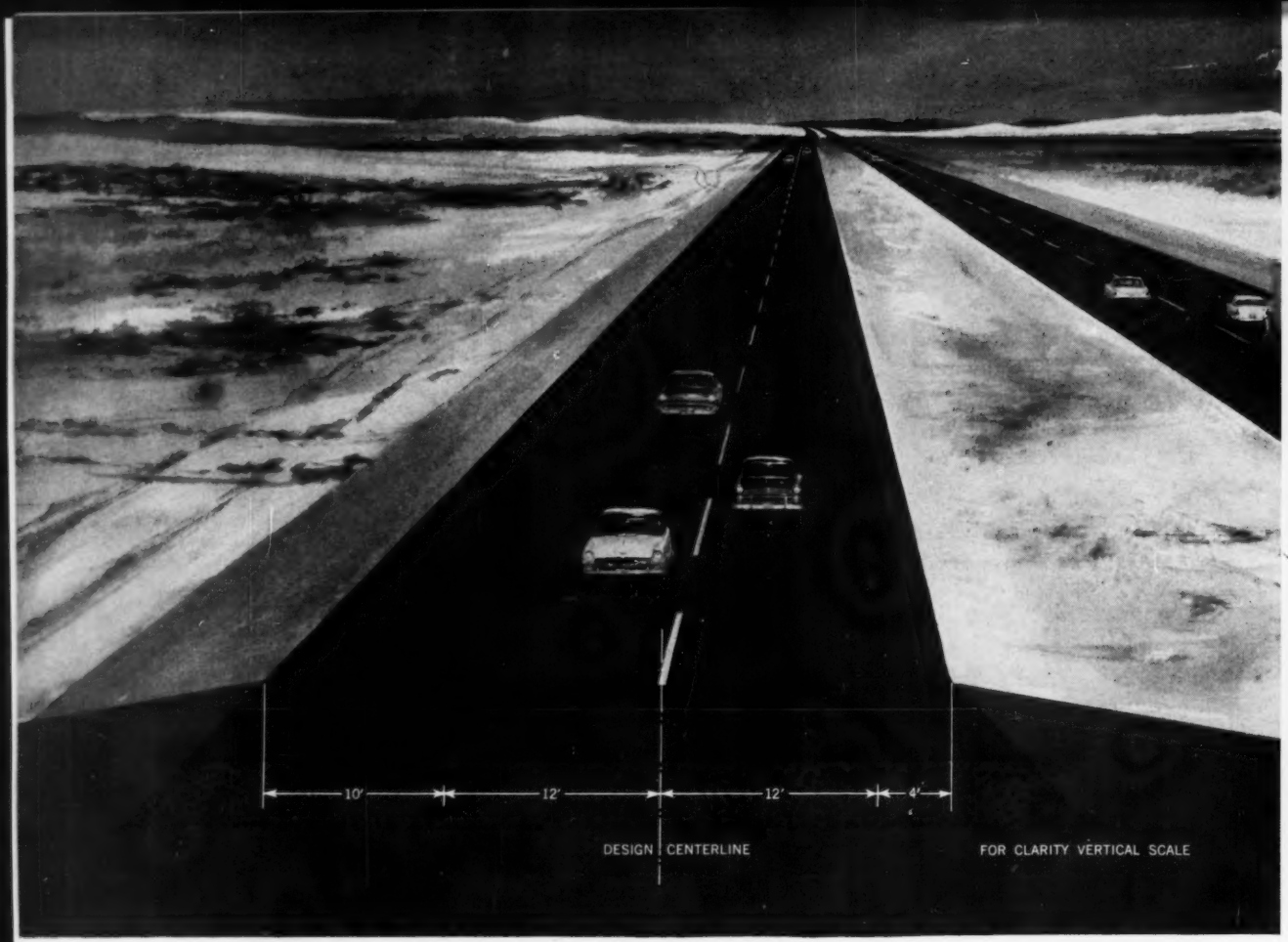
State_____



Arizona's First Interstate

Experience with veteran 2-lane Asphalt

Arizona is a big state with a low population density—which means it needs plenty of roads. But there aren't millions of Arizonans to pay for them. Every dollar counts.

These are some of the reasons why most of Arizona's roads traditionally have been of economical Asphalt construction. Time and again, since the State began to pave, Asphalt pavements have stretched available funds over more and more of these long Arizona miles than could any other pavement type.

Now, along with the rest of the states, Arizona has launched a vast new road-building program. And even though more federal aid is available than ever before, these roads, too, are turning out to be Asphalt-paved. You don't have to look far for the reasons.

Arizona's veteran Asphalt-paved highways have proved themselves as rugged and durable as they were economical to build and maintain.

U.S. Route 66 between Winslow and Holbrook is an example. First paved more than 25 years ago (with Asphalt and sand!), this pavement is successfully supporting heavy traffic undreamed of when it was first built. "Double" trucks by the dozen barrel over it at 60 MPH. So does the bulk of Arizona's east-west traffic.

Now this veteran main artery, still in the prime of its life, is being given local traffic responsibilities. A new divided Interstate Highway (Route 40), carrying through traffic, will parallel it. The initial section of Arizona's new Interstate 40 is shown above. It is a 5.6 mile stretch between Winslow and Holbrook.

With no aggregate larger than ¾ inch available (and most under ¼ inch), only Asphalt construction could have been used to build this section of pavement up to Interstate standards. Total cost of the pavement structure was $1.75 per square yard!

½" WEARING COURSE
1½" ASPHALT PLANT MIX LEVELING COURSE
6" ASPHALT CURB
THE "WAFFLING" INTERLOCKS COURSES
1½" ASPHALT PLANT MIX BINDER COURSE
3" ASPHALT STABILIZED BASE (RC3)
VARIABLE 6" TO 15" SELECTED SUB-BASE
OF PAVEMENT IS EXAGGERATED
SUB-SOIL

Segment Asphalt-Paved!

pavements leads to decision

The cross section above shows you in detail how low-cost Asphalt materials were used to give this pavement lasting strength despite the scarcity of aggregate.

Notice, first, the use of Asphalt in the 3-inch base. This base, a sandy gravel, was road-mixed on the selected sub-base using RC-3 liquid asphalt.

Notice, second, (see right roadway above) that the 3-inch leveling course was asphalt plant-mix laid down in two courses. A novel between-course inter-lock was provided by "waffling" the lower course while still hot with a 4-inch square grid pattern, impressed about ⅜-inch into the surface. A tack coat was applied and a second course constructed. Then, a ½-inch wearing course was laid to insure a non-skid surface.

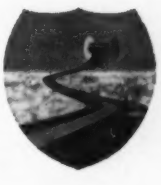
Notice, third, that both base and surface courses are uniform across the whole width of the road, shoulders as well as traffic lanes.

Notice, fourth, the use of Asphalt curb to provide controlled drainage, prevent embankment erosion and aid safety.

BEAT SCHEDULE BY TEN WEEKS

With today's equipment, modern heavy-duty Asphalt concrete pavement is being laid at record, reputation-building, tax-fund-conserving speeds. In this case, construction was completed 10 weeks ahead of schedule . . . in plenty of time to accommodate the bulk of the summer tourist traffic.

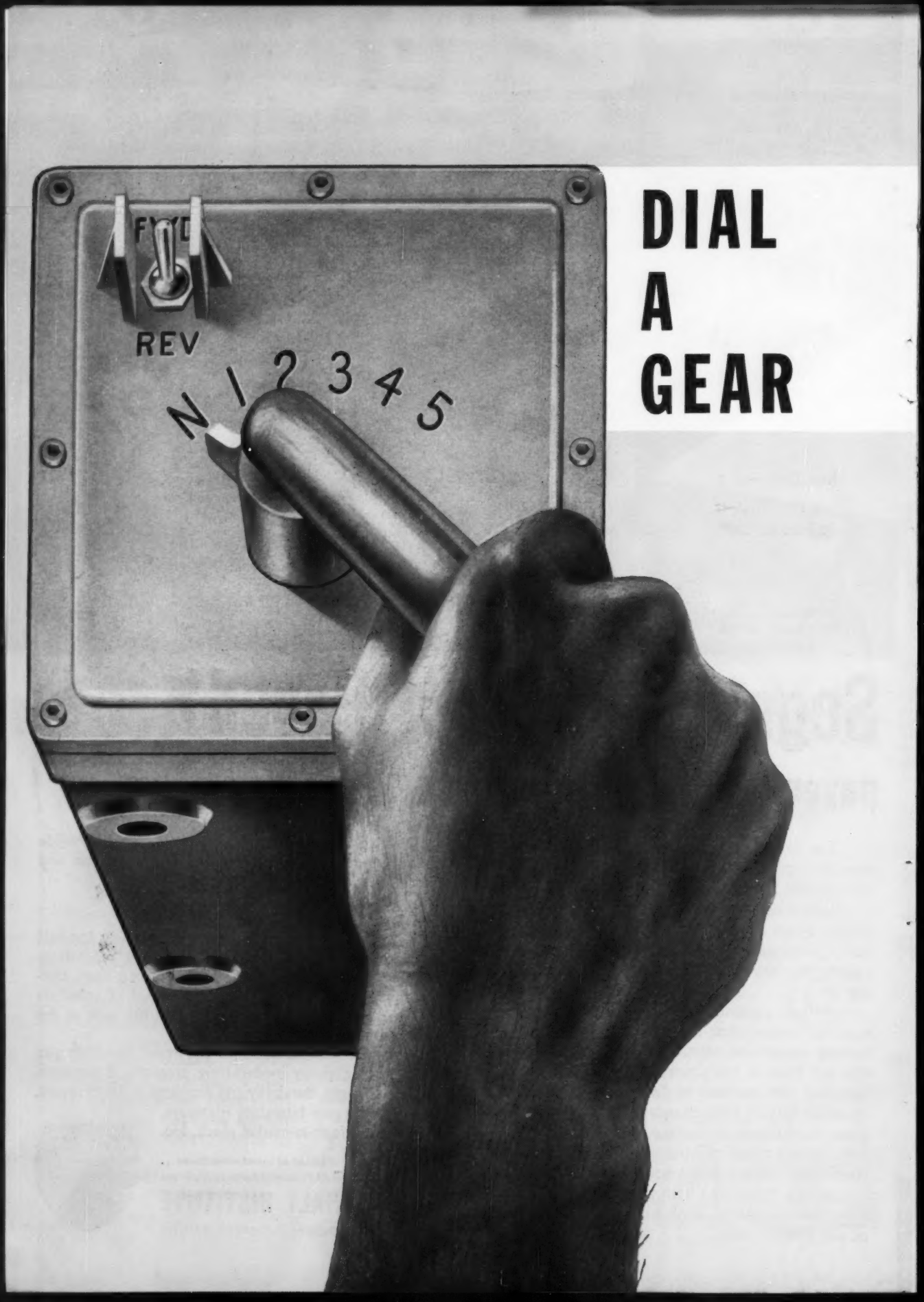
Modern Asphalt concrete pavement can help **you** speed your highway modernizing program. It provides, as well, strength, durability and economy in full measure. Specify it for your Interstate Highways. Primary and farm-to-market roads, too.



Ribbons of velvet smoothness . . .
***ASPHALT**-paved Interstate Highways*

THE ASPHALT INSTITUTE

Asphalt Institute Building, College Park, Maryland



DIAL A GEAR

CATERPILLAR'S **NO. 1 PROJECT** *pays off again*

FOR TOUCH AND GO SHIFTING WITH SYNCHROTOUCH TRANSMISSION CONTROL

Now Caterpillar research gives you an advanced new way to shift gears. Operator simply dials desired gear. Split-second shifting. Available for DW20 and DW21

From Caterpillar's No. 1 Project* comes one of the most important earthmoving developments of recent years—*SynchroTouch Transmission Control.* This remarkable advance combines economical direct drive transmission with the easiest, fastest shifting imaginable.

SynchroTouch Transmission Control is an optional arrangement for Cat DW20 and DW21 Tractors that permits effortless shifting of transmission gears by means of a gear selector conveniently placed near the operator's right hand.

To shift up or down, the operator simply moves a selector switch to the desired gear. In less than a second it is engaged. The standard foot clutch is retained, but it is used only when starting from a standstill.

Fully job tested in the field, SynchroTouch Transmission Control is ready now to give you these important benefits:

1. Faster shifting—for faster cycles, more payloads per hour.
2. A significant reduction in operator fatigue—for more daily production.
3. Economical direct drive transmission—uses standard DW20 and DW21 transmission and clutch components.
4. No special maintenance required.

Add SynchroTouch Transmission Control to either the new DW20 or DW21 (Series G), and you have the last word in modern, high-speed, efficient earthmoving equipment. Both of these outstanding Caterpillar wheel-type Tractors are delivering more horsepower (345 HP), rimpull and capacity than ever before. Now, see them in action with the SynchroTouch Transmission Control!

Call your Caterpillar Dealer and ask to see a new DW20 or DW21 with SynchroTouch Transmission Control as soon as possible.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

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BORN OF RESEARCH PROVED IN THE FIELD

HOW IT WORKS

SynchroTouch Transmission Control uses hydraulics as a source of power and is activated and controlled electrically. When the desired gear is dialed on an upshift, the following sequence occurs in a split second:

1. Control Unit signals master clutch to disengage.
2. Control Unit signals hydraulic system to shift transmission to neutral. Shifting collar is disengaged from present gear.
3. Generators notify Control Unit when transmission is synchronized for shift (shifting collar and desired gear at same RPM).
4. Control Unit signals hydraulic unit to shift to desired gear. Shifting collar engages new gear.
5. Control Unit signals master clutch to re-engage. SHIFT COMPLETE.

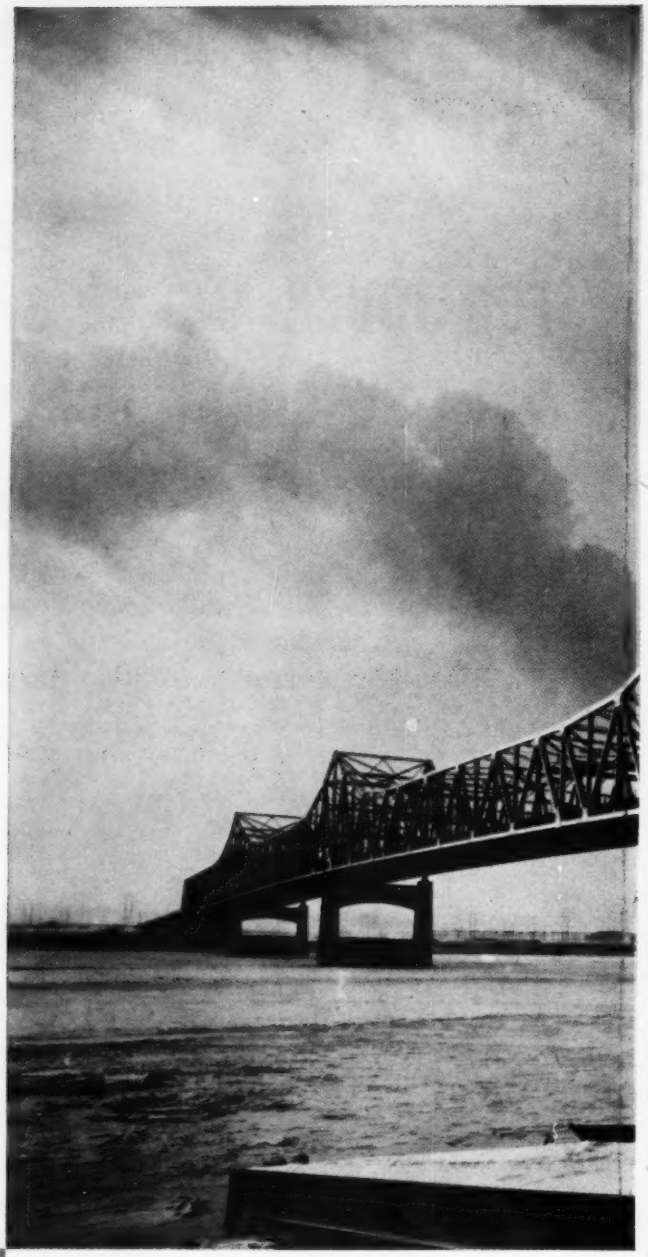
*Caterpillar's multimillion-dollar research and development program—to meet the challenge of the greatest construction era in history with the highest production earthmoving machines ever developed.

USS TRI-TEN STEEL

saves $175,000

IN ILLINOIS RIVER BRIDGE

New color movie available—"Challenge at Carquinez." A 27-minute, 16mm. color film showing the design and construction of the unique Carquinez Strait Bridge. Ideal for engineering groups. For booking information write United States Steel, Pittsburgh Film Distribution Center, 525 William Penn Place, Pittsburgh 30, Pa.



Five-span cantilever bridge, Peoria, Illinois, carrying two 26-foot roadways. Total length of spans—2,340 feet. Designer: State of Illinois, Dept. Public Works and Buildings, Division of Highways. Fabricator: Allied Structural Steel Cos. Erection by Industrial Construction Co.

$176,000 was saved by the use of USS TRI-TEN Steel in heavily stressed chords and diagonals, where it eliminated 850 tons of deadweight.

This spanking new Illinois River Bridge at Peoria takes advantage of the cost-saving features of high strength steel. USS TRI-TEN Steel was used wherever it would save money—and this was in most of the chord members and about 70% of the diagonals. These parts could be made thinner and lighter because of TRI-TEN Steel's minimum yield point of 50,000 psi. The bridge is all of 850 tons lighter than conventional construction would have been.

From 20 to 40% less steel was used in the high-strength low-alloy steel members. Less complicated members and fewer side plates was another consequence of using TRI-TEN Steel, leading to lower fabrication and erection costs—and, ulti-

mately, fewer maintenance problems. It is estimated that $175,000 was saved by using TRI-TEN Steel.

USS TRI-TEN Steel is particularly recommended for welded structures. It has good workability and superior resistance to atmospheric corrosion and meets all the requirements of ASTM Specification A242.

Other USS High Strength Steels in the 50,000 psi minimum yield point range include USS MAN-TEN which combines strength with economy and USS COR-TEN for strength with outstanding resistance to atmospheric corrosion. Where a very high yield strength steel is needed, our USS "T-1" Constructional Alloy Steel combines weldability with 100,000 psi minimum yield strength.

For complete information on any of these steels, call our nearest sales office or write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS, TRI-TEN, MAN-TEN, COR-TEN and "T-1" are registered trademarks

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Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
United States Steel Export Company

United States Steel

28 miles of Asphalt

for this Texas State Highway

PHOTOGRAPHS

(Left) Power graders were used to spread leveling course of TEXACO Asphaltic Concrete over old pavement.

(Right) Mechanical paver lays second course of TEXACO Asphaltic Concrete. Note small roller attached to paver, which bevels edge of pavement.

CONTRACTOR
GULF BITULITHIC COMPANY, HOUSTON

This Texas project illustrates an important advantage of Asphalt highways — the ease and economy with which Asphalt paving can be strengthened to serve increased traffic.

To the existing Asphalt pavement on this 28-mile section of State Highway 87, Texas recently added a new, two-course surface of hot-mix Texaco Asphaltic Concrete. A strong, lasting bond forms between the new and old Asphalt courses, providing a pavement which readily copes with today's heavier traffic load.

The aggregate used in the new plant-mixed Texaco Asphalt surface on Route 87 consisted of uncrushed gravel, shell screenings and sharp field sand.

Helpful information on all of the heavy-duty, intermediate and low-cost types of Texaco Asphalt paving for streets, highways, airports and parking areas is supplied in two free brochures. Our nearest office will be glad to mail you copies. No obligation.

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for labor-saving efficiency!

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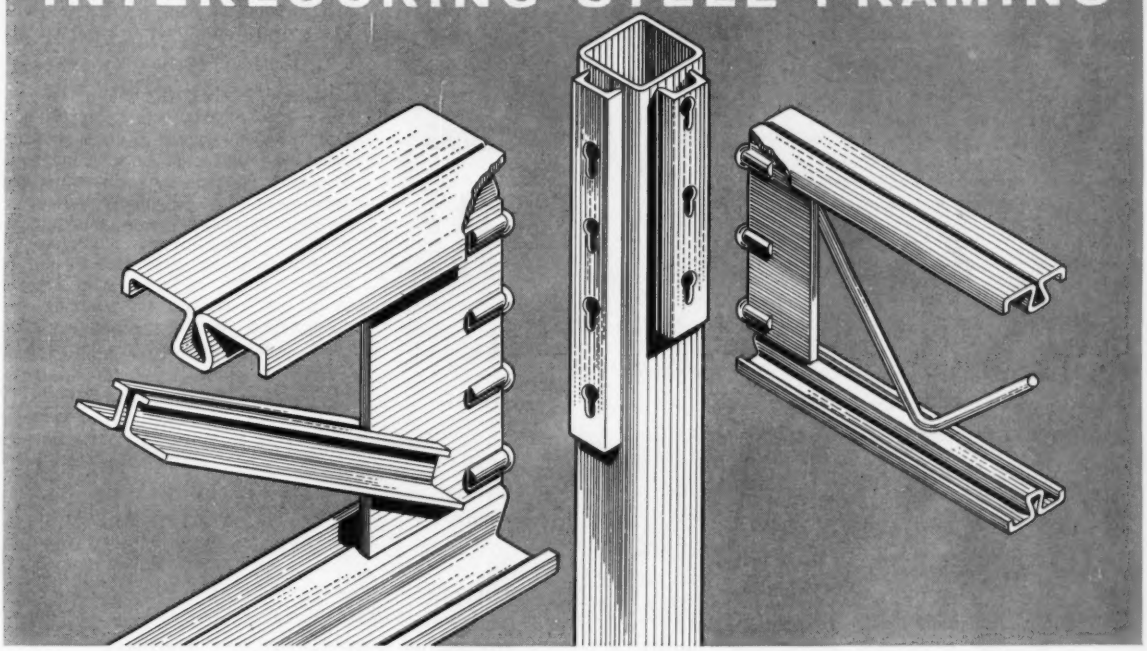
INTERLOCKING STEEL FRAMING



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Macomber standardized framing plans save time and steel. Macomber one-source supply keys to your structural schedule. Macomber engineered flexibility adapts to design variables, collateral materials and future expansion. Rigid V-LOK connections permit frame erection, ready for decking and interior finishing, weeks ahead of ordinary methods. Lower your next warehouse investment with V-LOK.

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MACOMBER

CANTON 1, OHIO

NEWS OF MEMBERS

Harry O. Fischer, Colonel, Corps of Engineers, on July 1 took over as the new division engineer of the North Central Division. He succeeds **Louis J. Rumaggi,** Major General, who is retiring after thirty-seven years of active military service. Colonel Fischer will be responsible for a $175,000,000 water-resource program in a twelve-state area in the Great Lakes vicinity.

James A. Burton recently retired as chief engineer of the E. B. Steele Company, Boise, Idaho, to become the new Asphalt Institute district engineer for the states of Idaho and Montana, with headquarters at Helena, Mont. As project manager for seven years for McAtee & Heathe, Inc., Mr. Burton headed the $2,000,000 paving project at Larson Air Force Base, Moses Lake, Wash.

Calvin Friar, until recently foundation engineer for the Union Metal Manufacturing Company, Canton, Ohio, has been appointed assistant district manager in the firm's Northern California-Northern Nevada District, with headquarters in San Francisco.

Raymond G. Miller, construction engineer with the City and County of Honolulu, Hawaii, has left the Islands to join the firm of Jacobs and Associates, as head of design in their Sydney, Australia office. For the past three years Mr. Miller has been tunnel engineer on the Wilson Tunnel Project in Hawaii.

Kenneth M. Allen, for the past six years a member of the Long Beach, Calif., engineering firm of Moffatt & Nichol, has been appointed chief engineer of the Pacific Bridge Company, of Alameda, Calif. While employed at Moffatt & Nichol, he supervised the development of plans for subsidence remedial measures at the Long Beach Naval Shipyard and the design of U. S. Navy carrier berthing facilities at North Island in San Diego.

Howard S. Ives, who retired as deputy highway commissioner of the Connecticut State Highway Department in 1956 to become general manager of the Edward Balf Company, of Hartford, Conn., has returned as highway commissioner. General Ives was appointed to fill the unexpired term (to March 1963) of **Newman E. Argraves,** who resigned on July 1 to enter private practice.

Andrew Fischer, Jr., one of the nation's leading construction superintendents, has been retained to direct the construction activities of Charles Luckman Associates, Los Angeles, architectural and engineering firm. He will organize construction supervision of Luckman projects in the Eastern United States, including the mammoth Prudential Center in Boston. Until recently, Mr. Fischer served as consultant on planning and construction of the new $130 million Chase Manhattan Bank building in New York.

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- Telescoping and Non-Telescoping Forms For Tunnels, Sewers and Conduits
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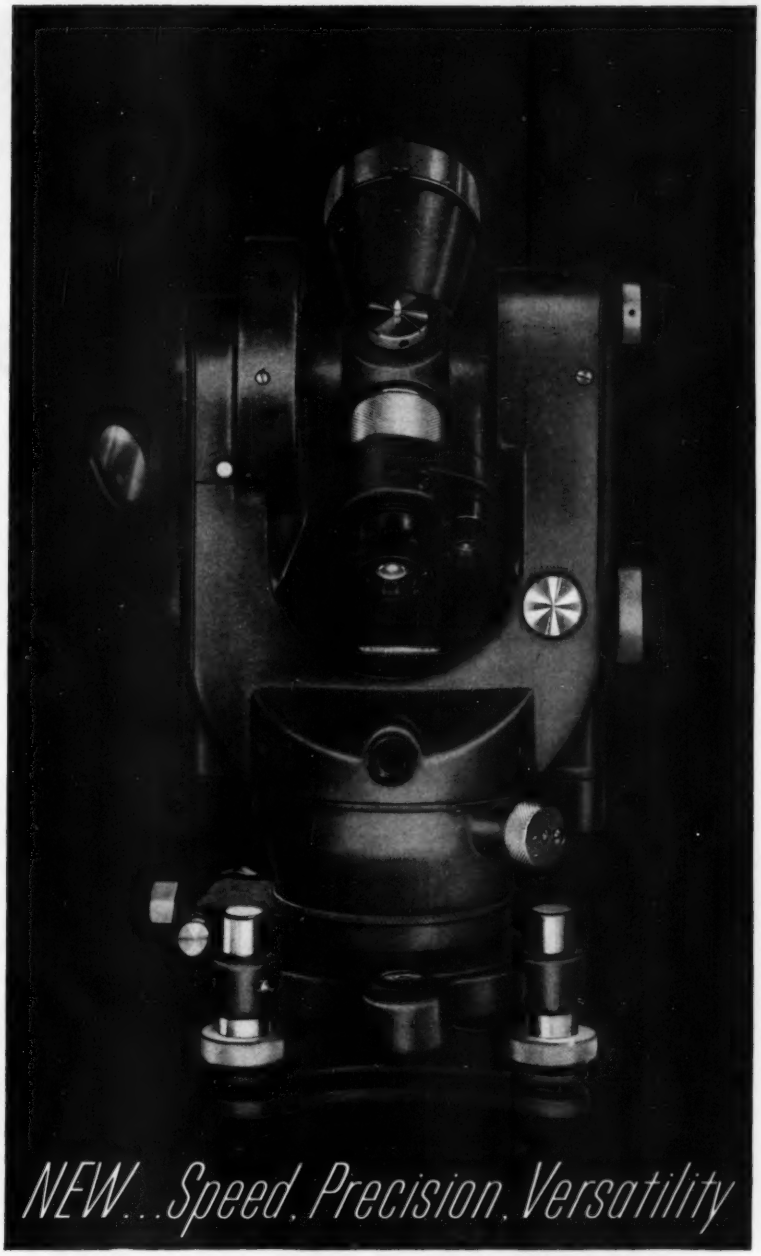
Edward J. Cleary, executive director of the Ohio River Valley Water Sanitation Committee, Cincinnati, was awarded an honorary doctor of science by his alma mater, Rutgers University. It was noted that under Mr. Cleary's direction his organization "has become the model compact wherein industry and government can work together to restore the regional heritage of a great river." Mr. Cleary has recently been in Germany, at the invitation of the Federal Member of Nuclear Energy and Water Economy, Prof. Seigfried Balke, where he reviewed administrative practice in water pollution control. In May he accompanied the German delegation to a meeting at The Hague of the International Commission on the Rhine River.

Robert Sumwalt, who joined the University of South Carolina as associate professor of civil engineering in 1926, has been named president of the university. He was appointed dean of engineering in 1943 and has been acting president since 1957. Professor Sumwalt is a past president of the South Carolina Section.

William R. Ganser, Jr., has been promoted from engineering assistant to staff engineer of the American Institute of Timber Construction. Mr. Ganser will be responsible for advising and maintaining liaison with architects, engineers, contractors, and others responsible for building design and construction. He will also serve as secretary of the institute's Standards Committee and will develop new technical bulletins and sales aids.

Francis S. Friel (left), President of ASCE, receives an honorary doctor of laws degree at Pennsylvania Military College's June commencement from Lloyd Gorman, president of the Board of Trustees. The citation for Mr. Friel, a prominent Philadelphia consultant, recognized him "for his countless achievements and profound knowledge; for his undisputed leadership in the civil engineering field, and for his energetic, single-minded devotion to the public welfare."

(Continued on p. 26)



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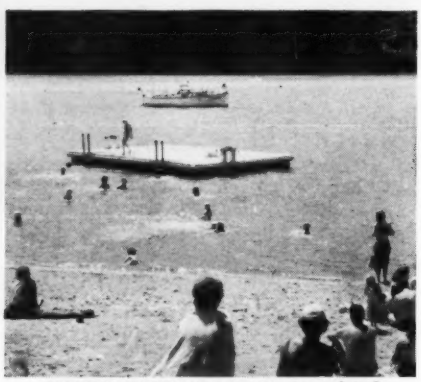
DANGEROUS WATER. Not long ago, faulty sewage disposal too often contaminated lakes and rivers... made them unfit for bathing, drinking or fishing.



MODERN SEWERAGE SYSTEMS, in which cast iron pipe and fittings are used, play a major role in keeping America's water clean, pure and wholesome . . . safe for bathing and drinking.

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Exacting quality checks from mine to main assure U. S. Pipe dependability

With leadership goes responsibility . . .

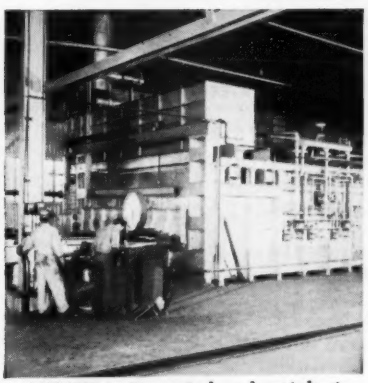
Cast iron pipe, for example, long recognized as America's basic water carrier, must be dependable and long-lived.

U. S. Pipe makes sure it is. By constantly checking and rechecking its pipe from start to finish . . . from mining to final casting.

The water officials who do such fine work planning and protecting the nation's water supply can be sure of this:

In U. S. cast iron pipe they have a fine ally to work with.

COKE, being discharged on coke wharf, has been made in our modern ovens from carefully blended mixture of coals obtained from U.S. Pipe mines.



HOT PIPE is inspected and weighed before entering the heat treating furnace. Each length of U. S. Pipe is subjected to temperatures automatically controlled for uniformity.

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INDUSTRIAL SERVICE CAST IRON

Birmingham 2, Ala. *A wholly integrated producer from mines and blast furnaces to finished pipe.*

News of Members

(Continued from p. 23)

Gordon P. Fisher, of the school of Engineering at Cornell University, has been promoted from associate professor to professor of civil engineering.

E. George Stern, head of the Department of Wood Construction at Virginia Polytechnic Institute, recently made a survey of wood construction and assembly practices during a 4½-week lecture tour in Europe and Asia. While in India at the Government's invitation, Dr. Stern was chairman of the session on timber construction at the four-day meeting of the Indian Building Research Organization. The subject of his lectures, better utilization of wood through assembly with improved fasteners, has been published as V.P.I. Wood Research Laboratory Bulletin No. 38.

Walter E. Blessey has been appointed chairman of the department of civil engineering at Tulane University. Professor Blessey joined the Tulane faculty in 1942 as an assistant professor of experimental engineering, and subsequently was appointed associate professor of bridge, structural and foundation engineering. He is a pioneer in the Southern area in the use and application of prestressed and light-weight concrete for many types of structures.

Harold F. Sommerschield, formerly a partner in the architectural engineering firm of Suter and Sommerschield, Chicago, has become associated with the Stanley Engineering Company with headquarters in Chicago. His professional career has extended over a period of more than thirty years and includes experience in hydroelectric and steam power developments, industrial and commercial buildings, fixed bridges, airport developments and business administration.

Henry H. Von Spreckelsen has resigned as account executive on public relations for Burson-Marsteller Associates, Inc., Chicago to join the Publications Department of the Bethlehem Steel Company, with headquarters in Bethlehem, Pa.

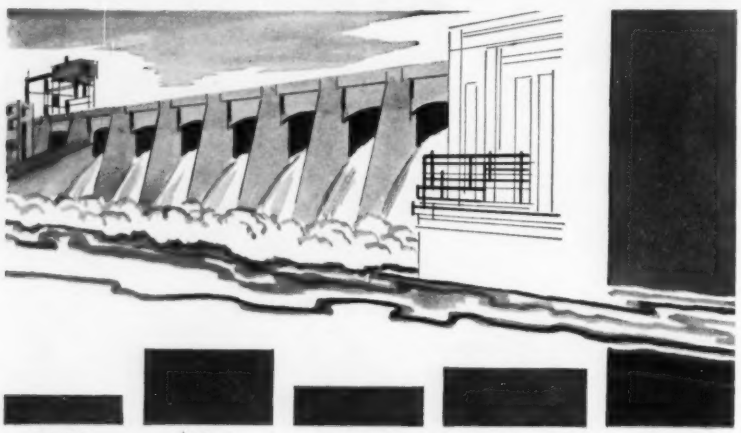
Ernest E. Michaels was awarded an honorary doctor of engineering degree by his alma mater, South Dakota State College, during commencement exercises on June 8. Long a prominent figure in the steel plate fabricating industry, Mr. Michaels has been president of the Chicago Bridge & Iron Company since 1956 and a director of the company since 1946.

Porter W. McDonnell, Jr., has been appointed to the newly created position of product manager of civil engineering instruments in an expansion program being conducted by the Eugene Dietzgen Company, Chicago. In the recent past he has served on the engineering faculty at the Case Institute of Technology in Cleveland and the University of Arizona in Tucson.

William R. Glidden is retiring from the Virginia State Department of Highways as assistant chief engineer after many years of service. Mr. Glidden served as President of ASCE in 1955.

John V. Spielman retired on June 30 as supervising engineer with the Safety of Dams Section of the California Department of Water Resources office at Los Angeles after a 14-year career as a specialist in the design, construction, and inspection of dams. Mr. Spielman has played an important role in the construction of forty new dams of all types, valued at upward of $38,000,000.

Bert C. Wilkas, president of the San Diego Section resigned as assistant chief engineer of the Helix Irrigation District in La Mesa, Calif., on June 1 to open his private civil engineering office in Lakeside, Calif. Prior to joining the staff of Helix seven years ago, Mr. Wilkas was employed by the U. S. Bureau of Reclamation on the design and construction of dams.



WATER—
World's Largest Industry

Annual U. S. production of steel averages about 120 million tons; coal, 600 million tons; agriculture, 400 million tons; petroleum, 340 million tons. But, based on weight, water supply is the largest industry.

In the United States alone public water supply averages about 70 million tons per day or 25 billion tons per year. Over 17,000 public water systems in the U. S. supply about 17 billion gallons daily to 111 million people. The average costs is about 10 cents per ton delivered in the home—a little over 2 cents per person per day. To do this requires an investment in plant and equipment of some 7 billion dollars.

The people of the United States now are the largest per capita consumers of public water supplies in all history.

The men who design, build, maintain and operate America's public water works deserve more credit than they receive for doing well a job which is vital to the public welfare and the national economy.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

Francis G. Yates formerly tri-lingual civil engineer with International Technologists S. A. of Paris, is now senior civil engineer with the University of California, Lawrence Radiation Laboratory, Mercury, Nev.

Frederick McCormick, manager of the Emu Bay Railway Company, recently retired after twenty-four years as manager of the railway company that for fifty-eight years has served the West Coast mining fields near Sydney, Australia. Mr. McCormick's biggest job was as engineer-in-charge of the huge Bunnerong power station which generates Sydney's power. Another major undertaking was as engineer-in-charge of the construction of Waddamana, Tasmania's first major power scheme.

George E. Symons has reopened his consulting office on a full-time basis. He will offer services as a consultant in the field of sanitary engineering and as a consulting editor and writer of technical articles, brochures, bulletins, market study reports, and research and development reports. Dr. Symons was recently appointed special consultant to the Engineering Services Division of the U. S. Public Health Service and American Water Works Association.

Gerald H. Teletzke is the newly appointed director of sanitary engineering research at the Eimco Corporation. In his capacity as director, he will be active in both the Process Engineering and the Filter Divisions of the corporation, which has head offices in Salt Lake City. Until recently Mr. Teletzke was associate professor of sanitary engineering at Purdue University.

Leslie Williams, president of Coordinated Planning Services, of Philadelphia, Pa., has gone to Ankara, Turkey, for a one-year program of advisory services in economic and social development and public administration under United Nations auspices. The assignment will center on advising the Government of Turkey on necessary steps to reduce the causes of accidents and expedite traffic, to assist in the revision of existing traffic legislation, and conduct a course on Highway and Transportation Planning at the Middle East Technical University.

Abbott Frank has been appointed consulting engineer for the Aircraft Nuclear Propulsion Department of the General Electric Company, with headquarters in Cincinnati. In this position he will be responsible for the systems integration of sites, facilities, and equipment required to activate the research, development, testing, fabrication and operational phases of nuclear aeronautical developmental programs and weapon systems. Mr. Franck is chairman of the ASCE Structural Division Committee on Nuclear Structures and Materials.

George Havas, general manager of the Heavy Construction Division and vice president of the Henry J. Kaiser Company, recently received the honorary degree of doctor of engineering from Rensselaer Polytechnic Institute "in recognition of his outstanding record as one of the world's foremost builders." The citation referred especially to Hoover Dam, Bonneville and Grand Coulee Dams; Drydocks of Mare Island, Bremerton, and Pearl Harbor; and the World War II Kaiser Shipyards.

Robert J. Armstrong has been elected vice president of Coakley & Booth, Inc., New York City foundation specialists. Mr. Armstrong joined Coakley & Booth as chief engineer in 1956.

Lawrence K. Murphy, of Augusta, Me., has been appointed district engineer for New England of the Asphalt Institute. In 1954 Mr. Murphy organized the Bituminous Paving Seminar for the Maine State Highway Commission. Mr. Murphy, who recently retired from his position as construction engineer and training coordinator with the Commission, will make his headquarters in Boston, where he succeeds **Robert C. Briggs.**

Loren W. Olmstead, Colonel, Corps of Engineers, received the Legion of Merit on June 23 for "exceptional meritorious conduct in the performance of his duties as Buffalo District Engineer." He was cited especially for his "superior skill, keen diplomacy and military competence" while in charge of the design and construction of the United States portion of the St. Lawrence Seaway. Colonel Olmstead is presently deputy assistant chief of engineers for civil works, an appointment he received earlier this year.

Herbert A. R. Austin, Donald S. Austin, Russell L. Smith, Jr., and W. C. Engebretson, principals and owners of Austin & Towill, Ltd., announce a change of name of their organization to Austin, Smith & Associates, Inc. The firm will remain at its present headquarters in Suite 502 in the Capital Investment Building, 850 Richards Street, Honolulu, Hawaii.

Elmer J. Maggi announces the opening of an office at 5107 North Seventh Street, Phoenix, Ariz., for the practice of civil engineering in the fields of structural, hydraulic, sewage and industrial design. Until recently he was associated with consulting and industrial firms in Phoenix, Los Angeles and El Paso, Tex. Mr. Maggi is general chairman for ASCE's 1961 Spring Convention.

(Continued on page 112)

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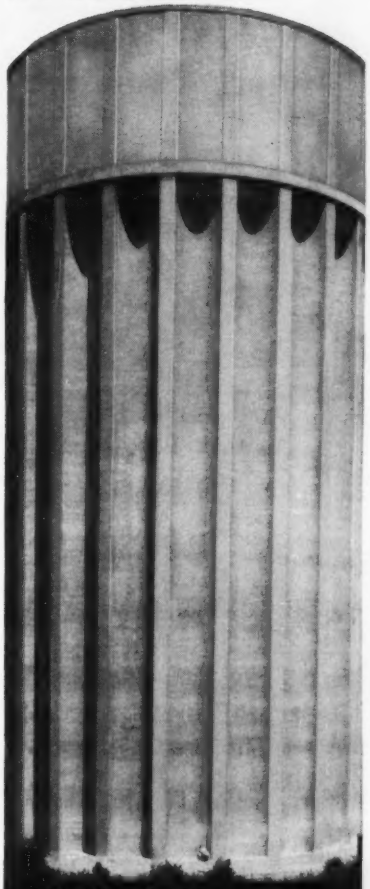

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HOW TO HANDLE WET JOBS

#49 of a series

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Contractor: Forcum-Lannom Inc., Dyersburg, Tenn.
Engineers: Burns & McDonnell, Kansas City, Mo.

Control 30 ft of ground water in coarse sand as wellpoints . . .

Keep Deep Cut Dry Close to Rising River

In pervious sand near the Arkansas River, Forcum-Lannom required a deep excavation going down 30 ft below groundwater table. Prior experience had indicated the area to be a difficult one for dewatering by the wellpoint method. A high pumping head, long discharge lines and a rising river level were among the problems.

• **Photo shows** what happened. The contractor had clear sailing as a 2-stage wellpoint system designed by Griffin engineers kept the excavation safe and dry. The lower-stage pumps pushed the water vertically a distance of 45 ft and then through 600 ft of discharge pipe to the river.

• **Ground water was held** below subgrade through 7 months of continuous pumping, with river level fluctuating 10 ft.

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. . . . . Am-Soc Briefs

▶ ▶ Civil engineering pay scales. . . . The general upward trend in civil engineering salaries noted in 1957 is continuing in 1959, according to the ASCE Committee on Salaries which has just completed the fifth in a series of biennial salary surveys. Significantly, salaries for educators are up over 11 percent while the overall professional picture is 6.2 percent. Returns received from 331 organizations, representing 64,080 employees, form the basis for the committee report, which is abstracted in this issue.

▶ ▶ Congratulations, chemical engineers. . . . The good news in the drive for member funds in the United Engineering Center campaign is that the American Institute of Chemical Engineers has exceeded its quota. ASCE still lacks $250,000 of its assigned $800,000 quota. There are now twenty Local Sections on the UEC Honor Roll — the newcomers the Puerto Rico and Wisconsin Sections.

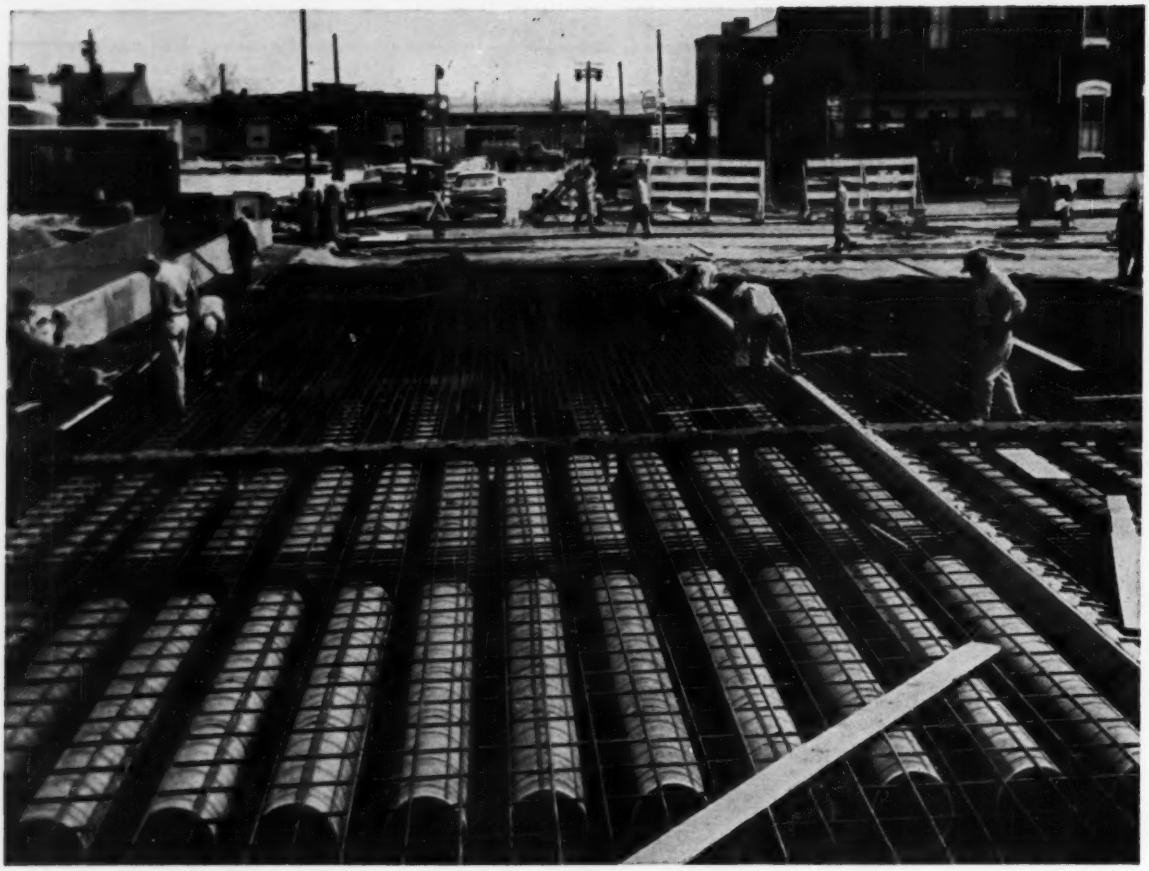
▶ ▶ Educators and employers will be interested in a "Younger Viewpoint" recommendation (this issue) that students earn a B.S. degree before embarking on an engineering curriculum. After two or, preferably, three years of intensive engineering study, the student would then receive a degree in his specialty — the equivalent of a medical or law degree.

▶ ▶ An essay into the field of management is being made by ASCE, with initial participation in the Annual Engineering Management Conference, set for Los Angeles, September 17 and 18. The conference, the seventh, is a joint Founder Society activity. Roger H. Gilman and E. Warren Bowden will represent ASCE.

▶ ▶ Through its Technical Divisions ASCE will participate in other significant activities. Set for Denver, Colo., August 27-29, is a Weather Modification Conference — a joint venture of the Irrigation and Drainage Division and the American Meteorological Society — planned to show that something <u>can</u> be done about the weather. . . . Further in the future is the Second Conference on Electronic Computation, to be held in Pittsburgh, September 8-9, 1960, with the Pittsburgh Section and the Structural Division Committee on Electronic Computation as sponsors. Prospective speakers must submit abstracts of their papers by November 30, 1959 (details in September). Prof. Nathan Newmark, of the University of Illinois, will be conference chairman.

▶ ▶ A reminder. . . . Members may receive the Journal of Professional Practice, issued by the ASCE Department of Conditions of Practice, instead of one of the two Technical Division journals to which they are entitled. This choice can be indicated in the regular box for Division enrollment.

▶ ▶ The National Science Foundation has allotted ASCE $24,800 to defray the travel expenses of our engineers who will visit Russia this fall in a joint exchange of U.S. and Russian soil mechanics engineers.



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The Upper Colorado River drainage basin covers an area of 110,000 sq miles? This vast region—larger than New York, New Jersey, and Pennsylvania together—is one of the most arid in the United States. To counter the effects of severe drought, the Bureau of Reclamation has been authorized to build four major storage and power units on the Upper Colorado, and its tributaries, above Lee Ferry. Already underway are Glen Canyon, a 700-ft-high concrete arch (highest in the U. S. except for Hoover Dam); Flaming Gorge Dam a, 495-ft-high concrete arch on the Green River, near the Utah-Wyoming state line; and Navajo Dam, a 405-ft-high earthfill on the San Juan River in New Mexico. The fourth unit —Curecanti Dam on the Gunnison River in Colorado— is still in the planning stage. Our thanks for this to *The Explosives Engineer.*

▪ ▪ ▪

Tokyo has a new subway? After eight years of difficult construction work, Tokyo has opened its second subway —an 11-mile, U-shaped, double-track link between the precincts of Ibekuro and Shinjuku. Built by the Teito Rapid Transit Authority, the new subway runs through the Tokyo business district, supplementing a 10½-mile line opened in 1927. Two other lines are being built, and still another is planned.

▪ ▪ ▪

New standard definitions for the pound and inch have been adopted? On July 1, under the auspices of the U. S. Bureau of Standards, six English-speaking nations met and ironed out differences between the U. S. and Great Britain's standard inch and pound. The change adds 1/300 to the U. S. ounce and 1/8,000 to the U. S. inch. Though the changes are too slight to be measurable on yardstick or bathroom scale, they are important in certain fields of research and manufacturing.

▪ ▪ ▪

Air traffic hit an all-time high in 1958? According to the Federal Aviation Agency's recent report, landings and takeoffs at the 213 traffic control towers operated by the FAA totaled 26,599,719 for the year—a 6 percent gain over 1957. The agency predicts still more of an increase in the current year.

▪ ▪ ▪

England is in the first stages of an extensive highway program? Not since Roman days, when the invaders built fine roads all over the island, has England taken its highway program so seriously. The initial unit, under construction now, is a $45,000,000 superhighway linking London and Birmingham. The full program calls for an 800-mile network of roads, providing speedy, safe connection between the major cities.

▪ ▪ ▪

The University of California has the world's second largest telescope? The 120-in. mirror just installed at the university's Lick Observatory, replaces the 100-in. Mount Wilson telescope as the world's second largest. Largest, of course, is the 200-in. installation at Mount Palomar. When the new telescope is placed in operation this fall, it will gather light from galaxies so distant that it takes their light (traveling 186,000 miles a second) a billion years to reach the earth. Grinding the four-ton Pyrex disk started in 1953 and involved the removal of 900 lb of glass. The mounting—a 53-ft tube, supported by a 150-ton steel fork—was designed by W. W. Baustian and erected by the Judson Pacific-Murphy Corporation.

▪ ▪ ▪

Experiments are being made with an Air-Car? An experimental model, developed by the Curtiss-Wright Corporation, dispenses with conventional wheels, axles, brakes, clutches, transmissions, and frames. Designed to operate on either land or water, the unit accomplishes both suspension and propulsion by the use of low-pressure, low-velocity air. The engine is a conventional piston-type unit, ranging in size from 50 to 200 hp. Land and water speeds of up to 30 mph are possible, but the unit is currently limited to 6 percent grades. It is said prices will be competitive with conventional cars.

▪ ▪ ▪

The nation's first atomic plant for distilling salt water will be located in California? According to Interior Secretary Fred A. Seaton, the U.S. will select one of seven possible sites in California this summer for the multi-million-dollar demonstration plant. The nuclear reactor, to be built by the Atomic Energy Commission, will provide steam for an enormous still capable of producing a million gallons of fresh water a day from the Pacific. The cost will be $1 per thousand gallons. The California atom plant will be one of three sea-water conversion projects to be built by the government. The first pilot plant will be built on the Gulf at Freeport, Tex., and the other at some site in the arid interior.

▪ ▪ ▪

There are more arguments for fluoridation of water? In a recent survey the U. S. Public Health Service found that the water supplies of 1,903 U. S. cities, with a combined population of more than 7,000,000, contain enough fluoride naturally to prevent two out of three dental cavities. Communities in 43 states use water in which fluoride occurs naturally. In Texas alone, 2.7 million persons, in 356 communities, use naturally fluoridated water.

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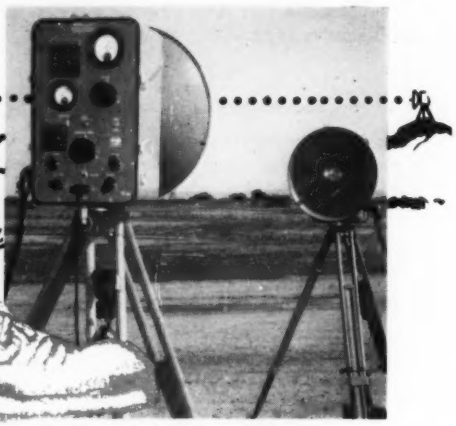

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CIVIL ENGINEERING

UNITY—
mirage or practical reality?

L. R. HOWSON, Past President ASCE
Consulting Engineer, Alvord, Burdick & Howson, Chicago, Ill.

Unity in our profession is probably the most discussed topic among engineers today. There appears to be universal agreement among individual engineers that the profession should be united—but there the agreement ends. A study of the present status of unity indicates wide differences of viewpoint as to what would constitute unity for engineers, what form it might take, its objectives, the things a unity organization ought to undertake and those it ought to leave to the present engineering societies, methods of financing, federal tax status and many other considerations.

It is believed worth while first of all to define the objective of a unity organization for the engineering profession. The following basic premises are offered:

1. There is no possibility (and I believe no desirability) in trying to return to the conditions of over a hundred years ago when the American Society of Civil Engineers was the only national engineering society in America. There are now several engineering societies having memberships of approximately 50,000 and dozens of others with smaller memberships, each of which through many years or decades of service has demonstrated its value to the profession and to human welfare.

2. While the individual societies have grown to best serve specific requirements, in many major respects all engineers have common interests.

3. Engineering progress has been accomplished through the educational, technical and professional activities of individuals and engineering societies.

4. Different societies place different emphasis on the relative importance of educational, technical and professional activities but all three are essential.

5. Engineering unity must be attained by consolidation rather than by division of either functions or societies.

6. It is more difficult to consolidate several hundred thousand individual engineers than a comparatively small number of societies. Enrolling engineers as individual members of a unity organization is believed to be wholly impossible and was so considered by 14 out of the 15 societies that studied unity organization. So far as is known, only about three of the three-score engineering societies of the country favor individual memberships in the unity organization.

7. The unity organization must be one that will serve the entire profession and all its needs. It must be one which will lend stature to each participating society and to the profession of which it is a part. It must enable each society to pursue individually the course for which it is best fitted and to cooperate with other societies on matters of common interest.

Statistics affecting unity

At present some 650,000 engineers are classified as such by the U.S. census bureau. The number has increased tenfold in each of the three preceding 50-year periods. The number of engineers is increasing at a rate of from two to five times that of the population as a whole. The number of engineering graduates now is between 35,000 and 40,000 per year. Of the approximately 650,000 engineers in the U.S., the total of those registered is about 220,000. But there are many duplications. For example, I am counted 30 times. It is believed that somewhere between 150,000 and 175,000 individual engineers are registered, or about one in four.

The National Society of Professional Engineers, which makes registration a prerequisite of membership, embraces some 50,000 members, or about one engineer of each three or four registered, or one engineer of each 15 in the United States. A recent survey of the ASCE membership disclosed that over 89 percent of those in its top classification are registered. This percentage far exceeds that in any society except NSPE.

As of the present time, 20 engineering societies are federated in Engineers Joint Council. Their combined membership is approximately 300,000. Also at the present time eight societies, five of which are also included under the EJC federation, are federated in ECPD. Their membership totals approximately 200,000.

ECPD and EJC are now considering a merger.

It may be helpful to review briefly the situation that gives rise to all this talk about unity. In 1852, when the ASCE was organized, there was but one national engineering society in the United States. Less than three decades later, splintering began, initially with the mining, mechanical and electrical branches. This has continued until there are now some 70 engineering associations with widely varying objec-

tives, qualifications for membership and accomplishments. Several engineering societies have memberships of 40,000 or more. One of the largest, the Institute of Radio Engineers, splintered from the AIEE in recent years.

More than 40 years ago the weakness in the engineering profession resulting from this wide diversity led to the formation of the American Engineering Council by the four Founder Societies, created primarily to meet problems that arose with World War I. Following the war some 70 engineering and allied technical groups federated with the American Engineering Council as administrative head. This organization became inactive about 1940 but maintained its corporate existence. In 1941 and 1942 the presidents and secretaries of the Founder Societies formed an Engineering Joint Conference, in order to strengthen their combined efforts during the war period. In 1945 these five groups established EJC.

In 1949, recognizing that the Five Founder Societies embraced only about one-third of the total of all engineers, and seeking means toward greater unity, an exploratory group, representing 15 national societies, was created. It recommended what was designated as the Plan A unity organization, with NSPE filing a minority report. The majority report by representatives of 14 societies recommended the expansion of EJC through admission of other engineering societies to the EJC federation. Twenty societies are now associated in EJC.

NSPE declined an invitation to join EJC but for some time accepted the invitation of the EJC Board to have an NSPE officer attend EJC Board meetings as an observer. I believe that invitation has never been rescinded, but NSPE has not availed itself of it for some years. In 1958, NSPE invited the five Founder Societies to send representatives to its board meetings. I understand that the AIEE and ASME had representatives at the recent Birmingham meeeting, possibly as individuals rather than official representatives.

At the October 1958 meeting of the Board of Direction of ASCE a resolution was passed reading as follows:

"Recognizing the importance of the National Society of Professional Engineers as a vital and dynamic influence for the advancement of the engineering profession and envisaging the great contribution to the profession that could result from the participation of that Society in both Engineers Joint Council and Engineers Council for Professional Development, the Board of Direction of the ASCE would view with high favor the simultaneous affiliation of NSPE with both EJC and ECPD, and hereby expresses the hope that it may have an early opportunity to approve and welcome such affiliations on an equivalent status with that of each of the five Founder Societies."

At this point it should be stated that NSPE had applied for admission to ECPD but not to EJC. Five of the eight society members of ECPD are the five major members of EJC. Admission of NSPE or any other society to ECPD would require a constitutional change and approval by two-thirds of the ECPD society members. The application of NSPE to the joint ECPD did not receive the approval of the necessary two-thirds of the societies. Accordingly, NSPE is not a member of either EJC or ECPD. I venture the opinion that had NSPE asked simultaneously for admission to ECPD and EJC, it would have been voted on favorably for admission to both.

The Coover Plan

In the summer of 1957, what has been designated as the "Functional Plan" or the "Coover Plan" was announced to the membership of the American Institute of Electrical Engineers—Coover being the name of its then president. This plan has been termed a "Unity" plan. Actually it is a division of engineering activities among three organizations, delegating engineering education to ECPD, coordination and cooperation on technical matters to EJC, and matters affecting professional development and economic status to NSPE. In this connection it is pertinent to point out that:

1. Substantially all engineering societies (other than NSPE) are interested in technical matters and 20 of them, with a membership of 300,000, now constitute EJC.

2. Practically all the engineering societies are interested in engineering education, although only eight of them, with 200,000 members, are now federated in ECPD. Three other societies, including NSPE, have applied for membership to ECPD.

3. Engineering societies are interested in varying degrees, and some not at all, in professional development and economic status.

The presidents of the five Founder Societies over the past year have had a number of meetings to discuss the entire unity matter. From those meetings I have formed the opinion that the functional plan as suggested by AIEE does not have a chance of adoption, although the distribution of responsibilities within a single unity organization along functional lines is believed excellent and can be incorporated in a single unity organization. I believe the Coover Plan, which essentially sets up three societies, each responsible for one function, would result in disunity rather than unity. It seems self-evident that unity is not accomplished through division. We must unite before we can apportion responsibilities.

It is logical that the Coover Plan should have originated with AIEE, which is not organized for professional activities. As previously stated, NSPE is not the only society interested in professional activities.

Because of my familiarity with ASCE I should like to call attention to a few professional activities of that Society, some of which are applicable to other societies as well. For many years ASCE has been expanding its professional activities, an effort that has received wide support from the membership. It could not now transfer those activities to another society, although the two groups might cooperate.

Many engineers seem to think that registration originated with and is a function of NSPE. That society is very active in registration at present but it was not even organized when registration was started and the Model Law drawn. As early as 1911, the *Proceedings* of ASCE contained a draft of "an act to provide for the licensing of civil engineers." In 1915 the Society was represented on a committee with five other societies to prepare a new draft of the law. This was followed by other revisions in 1920, 1925, 1927, 1929 and 1930, at which time the Model Law was presented as basic for registration of professional engineers and land surveyors, with a view to attaining a uniform high standard of engineering throughout the United States. ASCE was the first society to adopt this law. Seven other societies followed within a year. The latest revision was in 1946 with 13 societies collaborating. The high regard in which the Model Law has been held is evidenced by the incorporation of its principal features in many state registration laws.

While registration is recognized as a legal indication of minimum engineering qualifications and has recently been adopted as essential to top-grade membership in ASCE as well as in NSPE, it must be recognized that neither a college diploma nor a registration certificate MAKES an engineer. That is only accomplished when the individual contributes to human welfare.

Another activity in which ASCE carried responsibility was in assisting engineers drawn into collective bargaining against their wills during World War II. In October 1943 the ASCE appropriated $50,000 of its funds to retain legal counsel and employ four field representatives to assist and advise

where needed. The Society's legal counsel prepared various briefs in connection with labor situations at the Sunflower Ordnance Works, Kansas City, Mo., and the Clinton Engineer Works in Tennessee. So far as I know ASCE stood alone in safeguarding the rights of professional engineers on this issue.

When it became apparent that the Wagner Act should be amended in July 1946, ASCE instructed E. L. Chandler, at that time Eastern Representative with office in Washington to appear on behalf of the Society before a subcommittee of the House of Representatives during the 79th Congress. EJC voted that ASCE be requested to take the lead in working for an appropriate amendment of the Wagner Act, and E. L. Chandler was appointed Chairman of the EJC Labor Legislation Panel. An eminent attorney, Gerard D. Reilly, specializing in the field of labor relations, was engaged and paid by ASCE to help prepare appropriate clauses to be incorporated into the statute. The amendments prepared under Mr. Reilly's guidance, and sponsored by ASCE and EJC, were enacted almost verbatim into the Wagner Act, in the Taft-Hartley revisions.

ASCE has been in the forefront of improved ethical procedure for more than 60 years. In 1914 it formally adopted a code of ethics which with some relatively minor changes is in effect today. ASCE is the only national engineering society that has enforced its code of ethics through the avenues of admonition, suspension and, in extreme cases, expulsion.

Since 1923 ASCE has had a Committee on Professional Conduct to which all cases of unethical procedure are referred for study. It is just as inconceivable that NSPE could undertake the enforcement of ethics for all societies and administer punishment for infractions (as outlined in the functional plan) as that one family in a block could be responsible for the ethical conduct of all the families in the block and enforce discipline for them.

It is evident that ASCE cannot delegate to any other society, particularly one with which it is not even affiliated through a unity organization, those professional matters which it has handled so well for the membership and the profession over the years. Other societies would be similarly affected in varying degrees.

Relation between EJC and ECPD

EJC and ECPD are essentially creations of the same parent societies. ECPD has largely concerned itself with educational matters, of which the outstanding contribution has been the accreditation of engineering curricula.

EJC has primarily concerned itself with technical matters, public affairs and matters affecting the welfare of the public and the profession. In many respects it is better equipped to do certain things for the engineering profession than are the individual societies. Illustrative of this fact is the outstanding work of the Engineering Manpower Commission, the draft of a National Water Policy by a panel of distinguished engineers, the work of the Air Pollution Committee, the Task Committee on the Practice of Consulting Engineering, the Committee on Engineering Science working with the National Science Foundation, and the consideration now being given by a Joint Task Committee of EJC and ECPD to a survey of the engineering profession. EJC has an International Relations Committee active in UPADI, UNESCO, the U.S. Committee on Large Dams, and the U.S. National Commission of the World Power Conference.

It has long been felt that if EJC and ECPD were merged, the activities of both could be more efficiently carried out. A committee of six, three representing each society, was appointed to study means by which this could best be accomplished. This committee submitted a report to EJC at its annual meeting on January 17, 1959, in New York. It recommended the merger of ECPD and EJC under the corporate organization of EJC but with a new name yet to be selected. Any such move must be ratified by two-thirds of the federated societies in each group. It will probably take several months to effect the merger.

Tax status

In general the engineering societies have jealously clung to the 501-C-3 tax-exempt status now enjoyed by all the Founder Societies and most of the other EJC and ECPD organizations. Classification C-3 is available to organizations "operated exclusively for religious, charitable, scientific, testing for public safety, literary or educational purposes," and "which take no substantial part in activities or otherwise attempting to influence legislation and which does not participate in any political campaign on behalf of any candidate for public office." ASCE and EJC have been interested and effective in matters of government policy and occasionally have actively urged specific legislation but always have retained their tax-exempt status by keeping such activities from becoming a substantial part of their total activities.

NSPE, which does participate in attempts to influence legislation, does not enjoy tax-exempt status. It is understood that if a society such as ASCE were to delegate this function to NSPE and contribute a substantial amount for use in influencing legislation, it would impair its tax-exempt status. On the other hand, if NSPE were one of a federation of societies, it could continue to spend such funds of its own as it saw fit, and further, could represent the federation in legislative matters so long as such representation was not a "substantial" part of the activities and expenditures of the federation as a whole.

Weakness of EJC

As I traveled over the country rather widely while president of the ASCE, I became convinced that one of the major weaknesses of EJC is that it is not understood by engineers. Most of them have only a vague idea of how it is organized and what it is trying to do. Recently President Enoch R. Needles of EJC wrote a letter to the president of each society, asking him to appoint a committee and submit a report on how EJC could act effectively as "an intersociety council or organization through which common problems of the entire profession can be dealt with most effectively through the unified efforts and support of the constituent organizations." Several society committees have reported. These reports and recommendations were submitted to the EJC Planning Committee for review and evaluation. O. B. Fraser, Chairman of that Committee, reported at the January 17th meeting of EJC in New York as follows:

1. Most societies that are members of both EJC and ECPD recommended that a strong effort be made to foster closer association and promote the idea of amalgamation of the two societies. Several of the member societies suggested that such a merger of the two councils could and should provide the nucleus for the long desired "unity organization" for the engineering profession.

2. Recommendations common to the reports of nearly all the societies included:

(*a*) More active or more extensive promulgation of the views of the engineering profession on public policies in national and international affairs.

(*b*) Development of a far more effective two-way communication between the Council and all the engineering organizations in the country.

(*c*) An effort to seek maximum public recognition of engineering achievements by proper use of all available media for communication.

(*d*) Increased financial support of EJC to permit maximum implementation of its programs for the benefit of the engineering profession.

(*e*) Unity in the profession was

given much consideration in the reports of the several societies. The so-called Functional Plan apparently is not supported by the majority of the member societies in that "it disregards the fact that all of the societies are composed of individual members; that every member society has some interest in the activities which the functional plan would assign solely to NSPE; that most of the societies would not be willing to abrogate such responsibility to another society, although they would be willing to coordinate their activities through a central committee of a Unity organization in which they would have direct interest; and because the Functional Plan, which provides for three necessarily independent groups—technical to EJC, educational to ECPD, and professional to NSPE— has no direct overall control."

The Planning Committee of EJC urges the establishment of better means of communication to all engineers, regardless of society affiliation or special interests, and further expansion of programs for dissemination of information to the public.

Summary

Views on unity may be summarized as follows:

Individual engineers want unity in the profession, although few have defined the term in their own minds or analyzed the means by which it might be effected.

Engineers Joint Council offers the most promising hope of unity in the profession since "splintering" started nearly a hundred years ago. In just seven years it has combined 20 societies with 300,000 members, into a federated corporate organization.

The merger of ECPD and EJC into a single corporate structure, as is now in process, will bring engineering unity closer to realization.

NSPE can best serve its members, itself and the profession by becoming a constituent member of the new unity organization.

The eventual unity organization should embrace all engineering societies on this continent, acting for them on matters of common interest but permitting each society to pursue by itself or in groups the specific activities in which it has interest and proficiency.

I believe that real progress toward unity is being made and that if it is considered objectively by the engineering profession, unity can and will be realized.

(This article is slightly abridged from Past-President Howson's address at the March 1959 meeting of the St. Louis Chapter of the Missouri Society of Professional Engineers.)

THIN ARCHES carry Illinois Toll Road

ROBERT J. McFARLIN, A.M. ASCE

Structural Engineer

Vogt, Ivers, Seaman & Associates

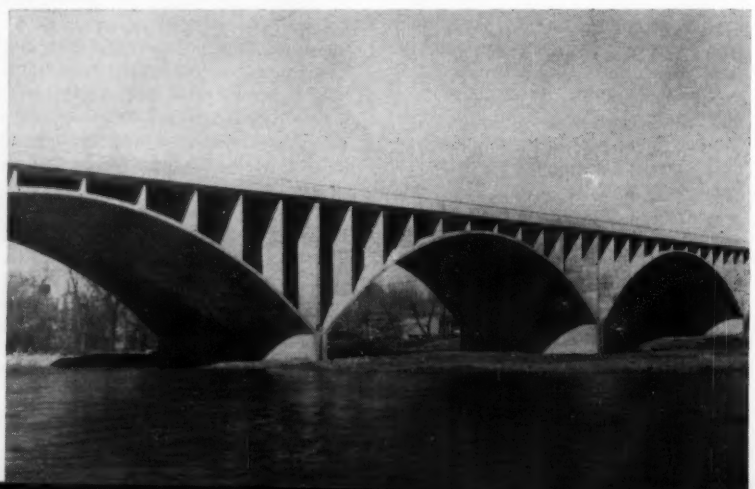
Cincinnati, Ohio

An unusual concrete structure carries the East-West Route of the newly opened Northern Illinois Toll Highway over the Fox River Valley near North Aurora, Ill. In this bridge the well-known standard prestressed girder spans of the Toll Highway are used in conjunction with braced barrel-arch spans. At this location, the East-West Route consists of a two-lane pavement in each direction, 25 ft 0 in. wide, separated by a 9-ft 0-in. paved median.

The predominant feature of the new bridge is its central unit of five arches, each spanning 178 ft, carrying the Toll Highway over the river proper. There are six prestressed-girder approach spans, four in the east approach across Illinois Route 25 and several railroad tracks, and two in the west approach where another railroad is crossed. Thus the bridge is made up of eleven spans and has a total length of 1,327 ft. Its cost was $2.2 million.

The arch barrels are only 14 in. thick, spanning their 178 ft on a circular arc of 133-ft radius. The contract specified that the falsework for each barrel should remain in place, to prevent deflection, until the transverse spandrel walls and roadway deck slab had been placed and cured above it. In this manner, frame action was accomplished,

Features of the new concrete bridge are five arches, each with a span of 178 ft. The arch barrels are 14 in. thick and are on a circular arc of 133-ft radius.



Various stages of construction progress are visible in this aerial photograph of the Northern Illinois Toll Highway Bridge over the Fox River Valley.

with the deck and walls contributing to the load-carrying capacity for both dead and live loads. The use of such a thin barrel is made possible by this frame action aided by concrete that attained a strength of 4,200 psi at 28 days. Braced arches of this type are used to some extent in Europe, particularly in Switzerland, but we know of no others of comparable magnitude in the United States.

Construction

The accompanying aerial photograph shows various stages of construction in progress on the arch spans. All the spans, including approaches, were numbered from left (west) to right (east) from 1 to 11. Thus Spans 3 through 7 are arch spans, of which Nos. 6 and 7 are seen to be essentially complete in the photograph. Concrete for the deck is being placed on Span 5. On Span 4, the spandrel walls are in place except for one at the west end, and forms are being placed for the deck.

On Span 3, the far (north) half of the barrel is in place, and the forms are ready to receive concrete for the south half. The use of a ½-in. open joint between these longitudinal halves was permitted as optional and was decided on by the contractor. At the west end of Span 3, the top form for the arch barrel can be seen extending up the barrel about one-third of the distance from abutment to crown.

Forms for all fives arches were placed at the same time, and there was no reuse of forms. This procedure was used to eliminate the need for providing resistance against unbalanced horizontal thrust at the piers, which would have occurred had the forms been removed from one arch before the adjacent arch was in place.

Each vertical member in the falsework is a timber pile, placed in a hole excavated in the bedrock, the space around it being filled with concrete. This excellent falsework system did not permit any measurable deflection under the dead load of the structure.

Design

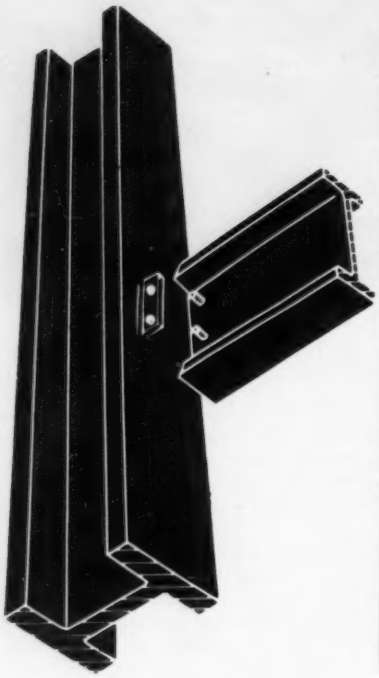
A conventional arch analysis, corrected for frame effects, was used for the original design, which was prepared with the aid of a Bendix G-15A electronic computer. This initial design yielded a barrel 16 in. thick, with main reinforcing of No. 10 bars spaced 1 ft 0 in. on centers at both top and bottom. This step was followed by the construction and testing of plastic models, both of a free arch and of a braced arch, to determine the frame effects more accurately. As a result of this work it appeared safe to reduce the barrel thickness to 14 in., with reinforcing of No. 8 bars spaced 1 ft on centers for both top and bottom.

Thin solid piers were used in the approach spans, as a repetition of the pattern set by the spandrel walls of the arches, in an effort to solve the difficult architectural problem of providing a smooth transition between the arch spans and the girder spans. The approach piers, like the arch piers, are founded on limestone bedrock.

The design was by Vogt, Ivers, Seaman and Associates, the section engineers, with the writer in charge. It was based on the original Engineering Report for the Northern Illinois Toll Highway, by Joseph K. Knoerle and Associates, Inc., consulting engineers to the Toll Highway Commission, in which a similar smaller structure was recommended at a more southerly site.

Jack R. Janney, M. ASCE, of Skokie, Ill., built and tested the plastic models, and also tested the finished structure. Bart J. Shine, F. ASCE, Professor Emeritus, the University of Cincinnati, was special consultant for the design. The general contractor was CKG Associates of Elgin, Ill.

The new highway bridge includes six prestressed-girder approach spans, four to the east across a road and several railroad tracks, and two to the west, where another railroad is spanned. Thin solid piers were used for the approach spans, repeating the appearance of the spandrel walls and thereby providing a pleasing transition between arch spans and girder spans.



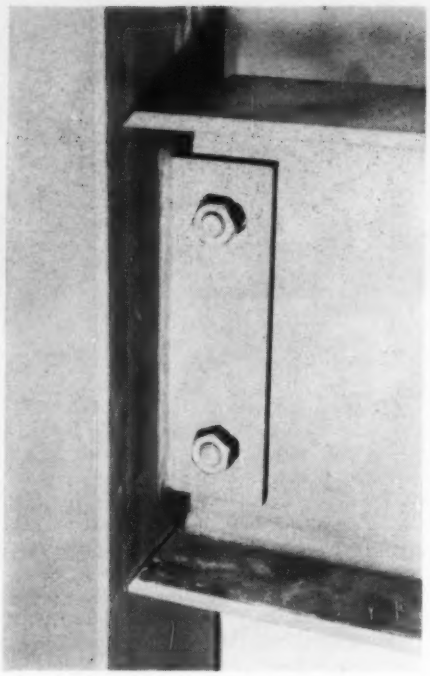


FIG. 1. Two welding studs placed on the web of the beam serve the same purpose as temporary erection bolts. No punching or drilling of the main member is required since a small attaching plate, punched to receive the studs, is welded to the column flange. Note slotted holes.

Welding economy with planned connections

OMER W. BLODGETT, M. ASCE,

Design Consultant

The Lincoln Electric Company

Cleveland, Ohio

Well-planned arc-welded designs can generally reduce steel and labor requirements for a welded structure from 10 to 25 percent. Frequently, however, some or all of this potential saving is lost in high erection and field welding costs. These costs can be greatly reduced by using some new ideas on joint design and erection.

Present methods of erection with web framing angles, angle seats, brackets and bolts many times involve extensive punching and drilling of main members, which add to both handling and material costs. Overhead as well as vertical welding is often required in the field for the resulting joints. Some of this added cost can be eliminated by using a system of connections that involves only downhand shop welding, welded studs for erection, and downhand field welding.

The connections here proposed were devised to meet the following basic requirements of welded beam-to-column and beam-to-girder connections:

1. The moment of the beam-flange connection.

2. The shear reaction transmitted from the beam web to the support.

3. Rotational ability, a requirement that becomes less important for fully rigid connections.

4. Ease of erection, the connection giving temporary support for the dead load of the beam plus some horizontal stability.

5. Good fit-up, essential to low-cost welding. A temporary connection should also have sufficient adjustment to take care of the dimensional tolerances of the column.

6. Accessibility for welding, both in the shop and in the field, especially important where beams frame into the column web.

Important items that greatly influence the cost of welded structural steel and cannot be overlooked are listed below. They must be considered if full advantage is to be taken of welded construction.

1. Rigid, continuous connections are needed for an efficient structure. Such connections will reduce the beam weight and may reduce overall frame weight.

2. The greater part of the welding on a connection should be done in the shop and in the flat position.

3. Miscellaneous plates used in a connection, such as seat brackets and column flange stiffeners, should be assembled, fitted and welded in the shop if possible.

4. Welding studs should be used on the main members in place of erection bolts in order to eliminate all punching or drilling of main members, which is very expensive. Welded studs have already been accepted in the bridge field for shear attachments, and an increasing number of structural fabricating shops have the equipment required for this type of welding.

5. Butt welding of beam flanges direct to the column instead of to connecting plates will result in a minimum amount of welding.

6. Vertical and overhead welding in the field should be avoided where possible since it increases the welding cost. This is because a lower welding current must be used, and this same low current is usually used on the remaining welds in the flat position since the welding operator cannot take the time to go to his machine to change the setting frequently.

7. Use of backing straps on flange butt welds will allow the joint to be made even if the fit-up of the beam ends is poor. Excessive root opening will increase the amount of welding required, but the joint can still be made.

8. If some vertical welding remains to be done in the field, consider having one or more welding operators do this with the lower welding current required, while the other operators are doing the flat welding with higher currents and a resulting shorter welding time.

9. Consider the use of a plate (shear plate) welded to the column in the shop in the flat position to carry the vertical shear reaction. The beam would be set on this plate, and no vertical welding would be required in the field.

10. Check to see if stiffeners between the column flanges are necessary, since they represent a good part of the cost of the connection. Recent research indicates that crippling of the column web is the deciding factor in most cases, and if the column web is thick enough, stiffeners are not required.

11. Consider the use of cover plates for the negative moment at the beam ends. Since this moment drops off quickly, the cover plate can be very short. A slight additional weight in cover plates will greatly increase the strength of the beam.

12. Many times the higher allowable unit stress of 24,000 psi is not taken advantage of for the negative moment at the beam ends. Using the customary value of 20,000 psi may result in excessive beam size.

The accompanying illustrations show a few possible variations for the proposed connections using welded studs for erection. Many other arrangements can readily be devised.

In Fig. 1, two welding studs are placed on the web of the beam to serve the same purpose as temporary erection bolts. The small attaching plate is punched to receive these two studs and then shop welded to the column in the flat position. No punching or drilling of the beam or column is necessary. The studs would probably be welded at the laying-out tables at the same time the beams are laid out. Since the welding studs are placed on the web of the beam, they are protected by the flanges and would not be likely to suffer damage during transit or erection. The small attaching plate can be punched with a slot in the horizontal direction of the beam to allow for some adjustment to take care of dimensional tolerance in the column size or beam length and yet give a positive vertical location for the beam.

The attaching plate on the column is also designed for the shear reaction and is welded in the flat position in the shop for minimum cost. Since the attaching plate would be punched with some type of template having the same distance

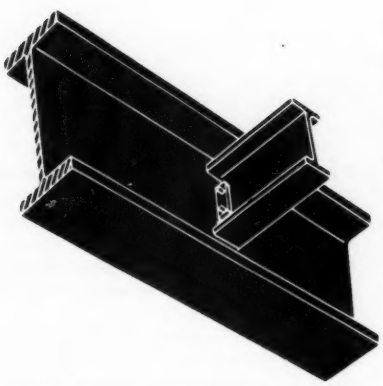


FIG. 2. A setup similar to that of Fig. 1 connects web of main member to web of beam.

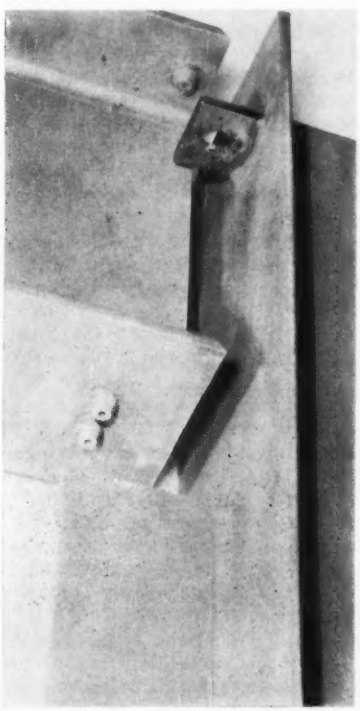
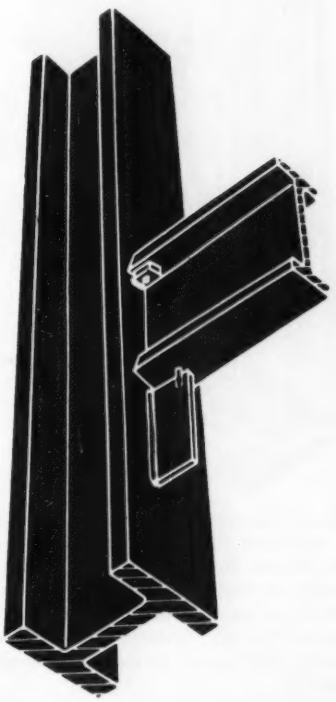


FIG. 3. Vertical welding in the field is eliminated by welding a seat plate to the column flange. After erection, the beam is securely positioned by the two welding studs on the bottom flange and a third stud which engages a small attaching plate welded to the column flange.



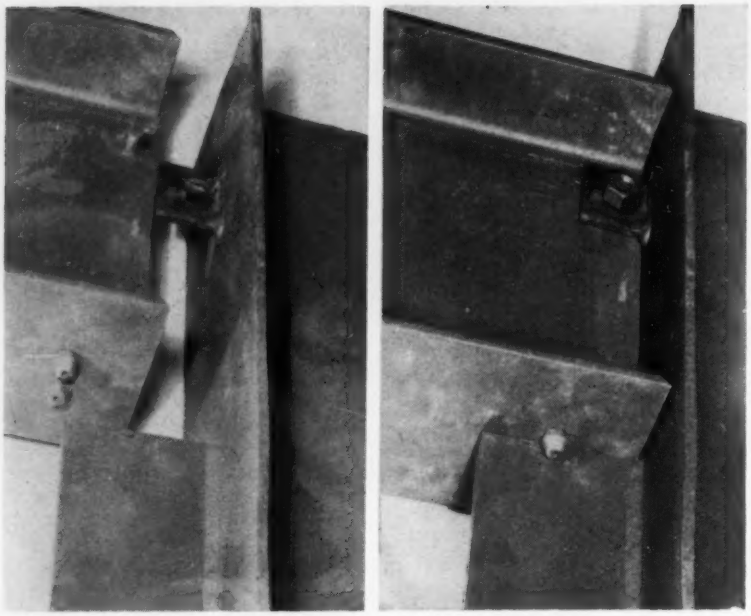


FIG. 4. In an arrangement similar to that of Fig. 3, the third welding stud is placed on the beam web near the top. In erection the beam is lowered into position and then rolled slightly to engage this third stud.

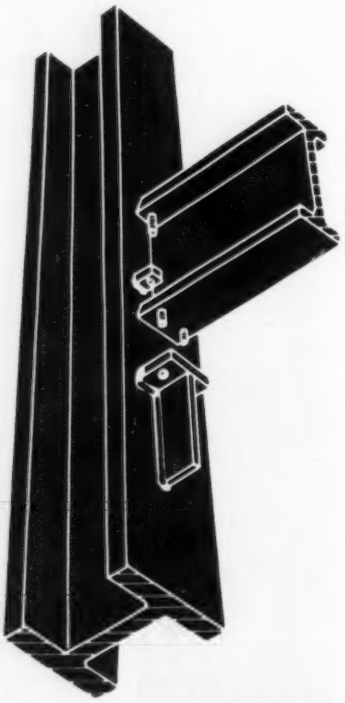


FIG. 5. A further variation of Figs. 3 and 4 utilizes a T-shaped seat bracket on the column flange, the horizontal plate being punched accurately to receive the two studs on the bottom flange of the beam. The third welding stud, at the top of the beam, provides horizontal stability.

between holes as the punch marks for the welding studs, there should be no difficulty in fitting the beam in place during erection.

The only field welding needed would be the butt welds for the top and bottom beam flanges and whatever vertical welding would be required for the shear reaction on the beam web. The flange butt welds would have the proper root opening and would use a light backing strap (about ⅛ in. x 1 in.). This backing strap could extend slightly beyond the butt weld so as to form a shelf or runoff tab to insure proper build-up at the ends of the weld. The backing strap could be easily held with a clamp.

A similar setup for the temporary attachment of a beam framing into the web of a main member is shown in Fig. 2.

By welding a seat plate to the column flange, as shown in Fig. 3, any vertical welding of the beam in the field could be eliminated. The plate would have sufficient size and attaching weld to transmit the shear reaction of the beam. Here two short welding studs are placed on each side of the center line of the bottom flange of the beam at its ends. Their spacing fits the thickness of the seat plate, and after erection they will keep the beam securely positioned over the seat.

A third welding stud is placed on the under side of the top flange of the beam and engages a small attaching plate, with a slot punched in it, which is shop welded to the column. The slot runs lengthwise of the beam. Erection involves only lowering the beam into position, so that the studs drop into place and hold the beam firmly for field welding. A possible improvement on this arrangement would be to have the two welding studs on the bottom flange slightly longer than the stud on the top flange so that they would engage the seat plate first. The stud just under the top flange could be threaded so that, when a nut was tightened on it, the beam would be prevented from being accidently knocked upward and out of the connection.

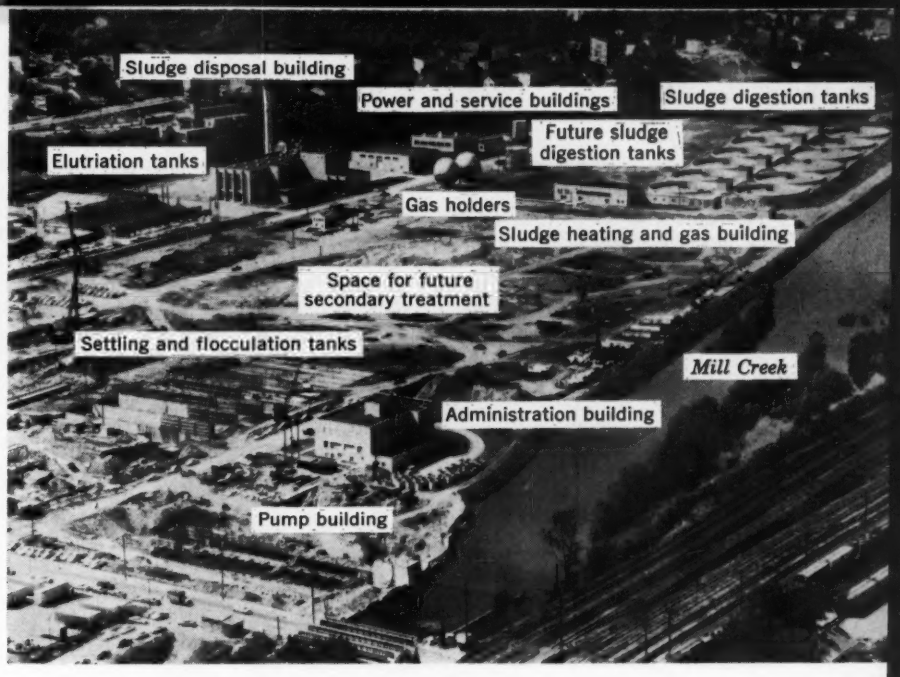
A slight modification is seen in Fig. 4, where the third welding stud is placed on the beam web near the top. The small attaching plate has a hole considerably larger, perhaps by ⅛ in., than the stud diameter. In erection, the beam is lowered into position as before, but must be rolled slightly to engage the web stud. A nut is drawn up tightly on this stud for firm attachment.

A further variation, Fig. 5, uses a T-shaped stiffened seat bracket with the horizontal plate punched accurately to receive the two studs on the bottom beam flange. The third welding stud is placed on the under side of the top beam flange to provide horizontal stability at the top of the beam.

All the vertical welding studs that are not threaded could have their ends beveled in the shape of the frustum of a cone, as shown in accompanying photos. This would permit them to enter the holes in the seat bracket more easily or to engage the seat plate more easily.

It is true that this use of welding studs, without holes in the main members, makes it impossible to use the tapered end of a spud wrench for bringing the beam end into alignment with the connection, as is customarily done. However the accuracy with which the welding studs and the corresponding slotted holes are placed—with the allowance for some horizontal adjustment provided by slotting—should avoid any difficulty.

Since these systems of connections utilizing welded studs assure optimum welding conditions, they permit full advantage to be taken of iron powder electrodes. Recent figures on a seven-story all-welded building show a saving of 25 percent on overall welding costs, including shop and field operations, realized principally from the use of E-6024 electrode for downhand fillets and E-6027 for downhand butt welds. On some field joints, economies ran even higher, up to 50 percent, by virtue of higher deposition efficiency, higher welding currents and less spatter.



At Cincinnati's new sewage treatment works, space is provided for future secondary treatment and additional tanks.

Cincinnati—MILL CREEK Sewage Works

ARTHUR D. CASTER, F. ASCE, Principal Engineer, Sewage Disposal, City of Cincinnati, Ohio

ALVIN M. MOCK, F. ASCE, Partner, Havens and Emerson, Consulting Engineers, Cleveland, Ohio

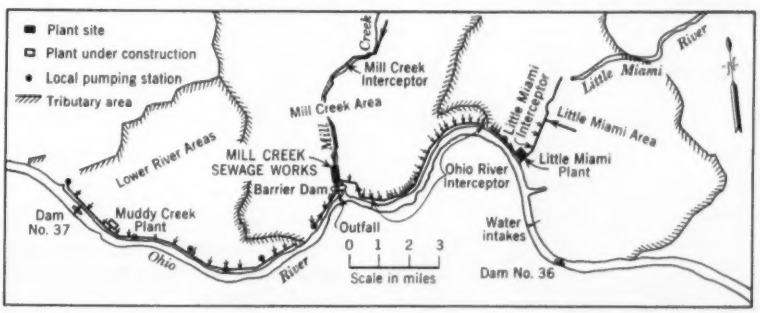
The Mill Creek Sewage Treatment Works, dedicated June 18, 1959, is the main treatment plant for Cincinnati's metropolitan area. Together with two other plants it serves the City of Cincinnati as well as 26 other municipalities and an unincorporated area in Hamilton County. It has a number of interesting features. A new idea in sewage treatment is the use of closed-circuit television on the raw sewage bar rack. The injection for the chlorinators is filtered plant effluent, and this filtered effluent is used for the flushing water for the wearing rings of the nine pumps that will handle 40 mgd. Outstanding flexibility is built into this unit for the disposal of sludge by filtration. The sludge can be conditioned by elutriation, ferric chloride or lime, or a combination of these.

The plant is on the west bank of Mill Creek about a half mile from the Ohio River, and within 2½ miles of the center of Cincinnati (Fig. 1). Since the site was formerly a city dump, covered with fills of debris from 15 to 40 ft deep, piling was required for all structures. The major process piping is all within tunnels to keep maintenance costs to a minimum. The area is on the flood plain of Mill Creek, and is protected by its own dike and by a Barrier Dam, which can be closed to shut out high stages of the Ohio River. Pumps are provided to control the flood level of Mill Creek.

Design features

The Mill Creek Sewage Works was designed to treat the sewage delivered by three principal interceptors to meet Cincinnati Pool Treatment Standard

FIG. 1. Mill Creek Sewage Works is only 2½ miles from the center of Cincinnati. Interceptors pick up sewage formerly discharged into the Ohio River and Mill Creek.



No. 1, as established by the Ohio River Valley Sanitation Commission.

The plant is of the primary settling type, augmented by pre-aeration and provision for the occasional use of coagulant. Provision is also made for use of chlorine for odor control and disinfection. Space is reserved and elevations established to permit the later addition of secondary treatment.

The principal units necessary to accomplish the present degree of treatment and dispose of the sewage solids are:

Pumping Station and Building

Grit Removal Building

Screenings macerator installation

Chlorination installation

Chemical storage, dosing and mixing equipment

Flocculation-settling tanks and sludge pumps

Outfall sewer

Sludge digestion tanks, heating and gas equipment

Power Building and equipment

Sludge conditioning, dewatering and disposal facilities

Administration Building and Laboratories, together with piping and conduits, Venturi meters, service facilities and shop, railroad siding, access roads and miscellaneous items

Studies for the total area tributary to the Mill Creek Plant indicated a population of 631,700 for the year 1980. Present plant design for mechanical equipment—pumps, screening units, and such—is based on an average flow of 120 mgd (million gallons daily) with acceptance of greater flows up to a maximum of 360 mgd. The raw sewage is characterized by suspended solids of 500 ppm (parts per million) and a biochemical oxygen demand, 5-day, of 400 ppm.

The main features of the plant and their functions can be seen from the flow chart, Fig. 2. In normal operation the sewage from the three interceptors is combined in the Diversion Chamber and then passes to the treatment works through twin conduits, which quickly expand into two channels within the ventilated bar-screen room of the Pump Building. Here the new sewage passes through mechanical bar screens of the back-rake type with 3-in. clear openings, and through two grinders for screening. From the bar screens, it flows through two gated openings into the Pump Building wet well, which has a capacity of 710,000 gal and feeds to nine 20- to 40-mgd, two-speed motor-driven raw-sewage pumps. Pump discharge is through one or both of two steel force mains of 96-in. diameter, which extend along the Pump Building and on to the Grit Building. Provision is made in these force mains for prechlorination.

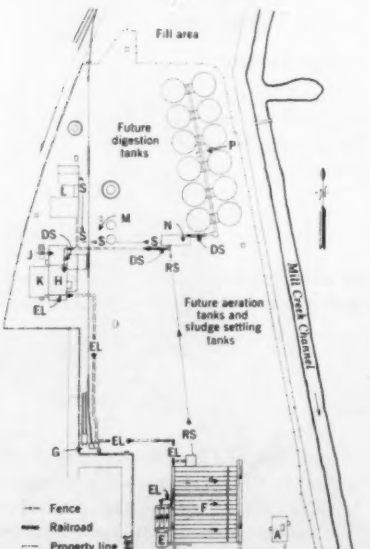
At the Grit Building, the force mains terminate in a rising well divided into two sections by a wall and stop planks. The outlet from the rising well is through six sluice gates into separated covered channels. Above each gate is an overflow opening for the purpose of relieving sewage inflow surges in excess of the capacity of the gates that may be open at the time. Each of the channels feeds past adjustable deflection guides into one of six grit chambers each 40 ft square, with a capacity of 20 to 60 mgd. These chambers form two batteries of three each, arranged in parallel rows about 52 ft apart and located within the open center court of the Grit Building. They are equipped with grit-removal mechanisms and grit cleaning equipment, which wash and elevate the grit for discharge into metal trays of 5-cu yd capacity placed inside the two drive-through walled and roofed truckways. These truckways constitute the north and south boundaries of the Grit Building.

Covered effluent channels serve each row of grit chambers and are interconnected at the west end of the Grit Building by an aerated cross-channel along which are six screenings shredders of 60-mgd each. The common effluent channel for this equipment has its outlet through twin conduits into the basement of the Chemical Storage Building. Here two Venturi meters measure, record and summate the sewage flow. The summated rate of flow is transmitted to the chlorinators in the easterly part of the Grit Building and to an indicating gage in the Raw-Sewage Pump Building. Alum, at a manually set rate up to four grains per gallon, is added after the Venturi meters if chemical dosing is necessary to meet treatment standards.

Sewage and chemicals will be mixed for five minutes in three aerated mixing tanks, each 19 ft wide by 91 ft long, with an average water depth of 11 ft. Here air can be added at the rate of 0.02 cu ft per gal based on a flow of 180 mgd. The flow in the channels between the mixing tanks and the flocculation tanks can also be aerated at a rate of from 1.2 to 2.0 cu ft of air per min per ft of channel.

Flocculation and settling are provided in the same tank, training baffles being used to separate the two functions. There are eight combined tanks, each consisting of two channels 19 ft 6 in. wide, having a flocculation length of 73 ft 6 in., a settling length of 212 ft, and an average water depth of 15 ft. These will provide detention in the flocculation zone for 30 min, and in the settling zone for 90 min, or a total of 120 min of settling time without flocculation, based on a daily flow of 120 mgd. The surface settling rate of the settling tanks, exclusive of the flocculation tanks is about 1,800 gal per day per sq ft of area, with an effluent weir loading of approximately 15,000 gal per lin ft of weir per day.

Each flocculation channel is equipped with two parallel rows of paddle wheels, and each row consists of three sets of paddles. Sludge collecting mechanisms are installed under the paddles in each channel of the flocculation tanks, as well as in each channel of the settling tanks. Sludge is collected from each



LEGEND

A. Administration Building
B. Diversion chamber
C. Pump Building
D. Grit Building
E. Chemical and Metering Building
F. Flocculation and settling tanks
G. Chemical unloading area
H. Sludge filtering area
J. Sludge incineration and drying area
K. Elutriation tanks
L. Power and Service Building
M. Gas storage holders
N. Sludge Heating and Gas Building
P. Sludge digestion tanks

		Max Flow
-CHL-	Chlorine solution	....
-RS-	Raw sludge	1.5 mgd
-DS-	Digested sludge	1.0 mgd
-S-	Sewage gas	1.8 mcfd
-EL-	Elutriate	2.5 mgd
-FM-	Force mains (120 mgd avg.)	360 mgd
-OF_1-	Plant outfall to river	360 mgd
-OF_2-	Outfall to Mill Creek	232 mgd
-CH-	Twin channels	360 mgd

FIG. 2. Flow diagram, Mill Creek Sewage Works. The outfall discharges into the Ohio River.

tank by means of motor-driven cross collectors. The raw sludge collected from each tank flows by gravity through pipes to a raw-sludge sump in the Sludge Pump Building. Sludge from this sump is pumped through a force main to the sludge digestion tanks.

Effluent from the settling tanks enters the outfall sewer, where provision is made for post-chlorination. This 10-ft-diameter outfall sewer has a length of about 3,300 ft beyond the treatment works. It extends 200 lin ft into the Ohio River, where it disperses the plant effluent about 25 ft below the river surface.

Power from sewage

Processing of sludge includes digestion, elutriation of digested sludge, chemical conditioning and dewatering by vacuum filters, and alternative incineration or drying of the filter cake. Each of the twelve 110-ft-diameter digestion tanks is equipped with a floating cover having an aluminum roof deck. Sewage gas will be stored in two spherical steel gas holders, under a pressure of 29.9 psi. Each holder is 45 ft in diameter and has a volume of 47,710 cu ft.

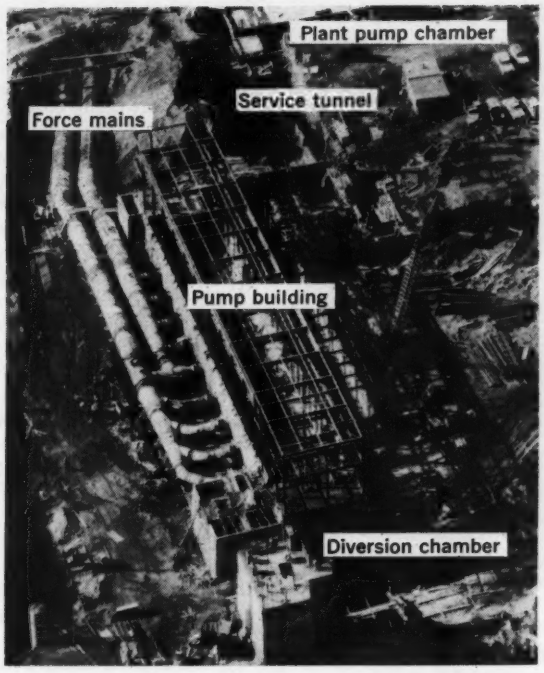
The gas will be used by four 1,910-hp dual-fuel supercharged diesel engines, each driving an electric generator. The four units will provide all the power required in the operation of the treatment works. The heat in the engine-jacket water will be used to raise the temperature of the raw sludge by means of sludge heat exchangers.

Before filtration, the digested sludge will be elutriated using a ratio of one part sludge to four parts wash water, a mixing time of two minutes and a settling time of four hours. Elutriated sludge will be dewatered by eight units, each consisting of a bucket elevator, a ferric-chloride feed machine, a lime-slurry feed machine, a conditioning tank and a vacuum filter 11 ft 6 in. in diameter and 14 ft long, which has a filter area of 500 sq ft. Six of the vacuum filters have string discharge and two are of the roto-belt type.

Filter cake from the vacuum filters will be either dried or burned in four multi-hearth units, each capable of processing 152 tons of sludge filter cake per 24 hours. The dryer-incinerator units have 9 hearths each and an outside diameter of 22 ft 3 in. A pneumatic ash-handling system will move the ash from each incinerator hopper to an ash storage tank 18 ft in diameter with a capacity of 4,700 cu ft. The ash, conditioned to prevent dust during transportation, will be moved by truck to a fill area on city-owned property north of the treatment plant.

Equipment is provided for prechlorination or postchlorination or both, with facilities capable of applying a total of 15 ppm of chlorine to 150 percent of the average design flow of 120 mgd. The principal items of equipment are four chlorine machines (one a spare), two vacuum controllers, two air compressors, and the piping and chlorine solution diffusers.

The chlorinators are vacuum-type units which, with interchangeable meter elements, will have capacities of from 600 to 4,000 lb, or 1,200 to 8,000 lb per 24 hours. A maximum of 600 gal per min of screened plant effluent will be used for chlorine solution water. The controllers will have the function of automatically adjusting the application of chlorine in the amount determined by the fluctuation of sewage flow as measured through the Venturi meters, and to bring in and disconnect



Pump building is seen under construction, with diversion chamber on incoming lines in foreground. Force mains lift sewage into grit building for gravity flow through the plant.

Major equipment suppliers for Mill Creek Sewage Plant

Location	Equipment	Manufacturer
Pump Building	Screening	Link-Belt
	Pumping	Fairbanks-Morse
	Switch gear	General Electric
Grit Building	Grit collection	Dorr-Oliver
	Comminutors	Chicago Pump
Chemical Building	Alum feeders	Builders-Providence
	Venturi meter & recorder	Builders-Providence
	Chlorination	Wallace & Tiernan
Mixing tank	Aeration	Chicago Pump
Sludge Disposal Building	Vacuum filters	Eimco
	Chemical feeders	Omega Machine
	Vacuum pumps	Pennsylvania Pump
	Elutriation tank collectors	Link-Belt
	Incinerators	Nichols Engineering
	Meters	Minneapolis-Honeywell
Sludge Heat Building	Digester covers	Pacific Flush Tank
	Sludge heaters	Pacific Flush Tank
	Gas compressors	Allis-Chalmers
	Gas spheres	Chicago Bridge & Iron
	Meters and recorders	Bailey
	Meters and recorders	Foxboro
	Meters and recorders	Connersville
Flocculation-settling tanks	Flocculators and sludge collectors	Jeffrey
Power Building	Diesels	Cooper-Bessemer
	Generators	Ideal Electric
	Switch gear	General Electric
General	Cone valves	Chapman
	Sluice gates	Chapman
	Sluice gates	Rodney Hunt

A 54-in. Chicago Pump Co. comminutor is used in the plant to cut particles in the sewage to treatable size.

Trackmobile is job workhorse to pull cars on rails or, by hydraulic lowering of its rubber-tired wheels, to haul vehicles around the plant roads.

Chief operators and maintenance foremen use Cushman motor scooters with special built-in bodies and trailers outfitted for special duties, such as this one with fire control equipment.

successive chlorinators as the sewage flow increases or decreases. It is possible to substitute manual for automatic operation.

The plant pump chamber, a separate underground structure, has the function of supplying strained or filtered plant effluent for chlorinator ejectors and for flushing the raw-sewage pumps. This chamber, which has an outside entrance with a louvered ventilator, adjoins the plant outfall leading from the settling tanks and also connects with the adjoining service tunnel through a bulkhead type of door.

Service tunnels of reinforced concrete, with an approximate inside width of 8 ft and height of 10 ft, contain process piping and electrical conduits and provide covered walkways between all the principal buildings of the treatment plant.

The Chemical Unloading Building contains a steam plant for use with the chlorine evaporator and related chlorine pressure-reducing and measuring devices, together with devices for unloading bulk alum from railroad cars or trucks.

The chlorine unloading station, adjacent to the Chemical Unloading Building, provides a covered area to protect the liquid chlorine tank cars while they are being unloaded on the railroad siding. The station includes a permanent ladder and platform to facilitate making the piping connections between chlorine cars and the liquid chlorine system.

Electric substations, located throughout the plant, receive primary electric power from the four 1,350-kw, 4,160 v, 3-phase, 60-cycle, 0.8 power factor, generator units in the Power Building. The substations meet the need for secondary power at 480 v, 3-phase, 60 cycle, for plant operation. Lighting at 120/240 v, 3-wire, is obtained from individual dry type transformers.

The air-conditioned Administration Building is the headquarters for the Division of Sewage Disposal of Cincinnati's Department of Public Works. The building includes a message center and offices for the Division's principal engineer and chemists, and its accounting, engineering, industrial waste and maintenance sections. There is a kitchen and first-aid room in addition to the industrial waste and plant laboratories.

The Service Building contains the offices of the Power Superintendent of the Sewage Disposal Division, foreman and maintenance personnel, a machine shop, storage for spare parts, service garage, utility room, lockers, showers and toilet room.

An innovation at this plant, as previously mentioned, is a closed-circuit television system, in which two cameras with flood lights are focused on the submerged part of the two mechanical bar screens, and transmit through a transfer switch to a single monitor mounted in the pump room of the Raw-Sewage Pump Building.

There is a sound system which provides four loud speakers in the Grit Building, and telephone service through the Administration Building switchboard, which extends to all principal structures throughout the plant.

Separate structures are used for paint storage, for the pumps of the fire protection equipment, the waste-sewage-gas burners, the sludge transfer station, oil storage, the refuse incinerator, and the gate house with waiting shelter at the main entrance to the plant. Facilities include paved roadways, a railroad siding, drainage structures, sewers, fencing, landscaping and a sprinkling system for the grounds.

Construction scheduling

Scheduling of construction was an important consideration in order to minimize interest costs during construction and idle time of equipment in place, in addition to the principal objective of getting the plant in operation as soon as possible. Consequently the items of work were included in eight major contracts:

Contract No. 1, site grading, railroad siding, and miscellaneous work; Contract No. 2, sludge heating and digestion; Contract No. 3, the Administration Building; Contract No. 4, the Service and Power Building; Contract No. 5, sludge dryer and incineration; Contract No. 6, the Sludge Disposal Building; Contract No. 7, the Pump and Grit Building; Contract No. 8, flocculation and settling tanks. Completion of the eight contracts covered a period extending from 1953 to 1959.

The major contractors were the H. W. Miller Construction Co., of Covington, Ky., on Contracts 2 and 4; the Ferro Concrete Construction Co., owned by the Turner Construction Co., on Contract 6; and Cunningham Brothers, Inc., of Beloit, Wis., on Contracts 7 and 8. Penker Construction Co. held Contract 3, and Nichols Engineering and Research Corp., Contract 5.

Roadways, landscaping and roadway lighting are expected to be included in Contract No. 9, to be let in 1959. The estimated total cost of engineering and construction is $26,000,000, including Contract No. 9.

OPERATION—

MILL CREEK Sewage Works

Designing and building a plant is only part of sewage treatment. Good operation is the goal sought. In the case of the Mill Creek Sewage Works, operation was planned for well in advance of plant completion. Personnel were trained to take over the work; equipment and supplies were selected and on hand in the amounts and at the locations required.

Organization

Actual operation for the Mill Creek Sewage Works is carried out on a 24-hour basis, 7 days a week, by special personnel classified as follows:

Operator 1: trainees, who do routine work and advance to

Operator 2: actual operators on the job

Operator 3: men who fill in for those in the Operator 2 and 4 classes during vacation and sickness, and must know the whole operation

Operator 4: the "chief operators"

The superintendent and an assistant must know and be able to direct every operation but their duties are confined to administration, planning, and the watching of overall costs.

Chief operators are required to have at least four years of supervising experience in sewage works and a Class B Operator License from the State of Ohio. Those in the Operator 3 class must have at least three years of supervisory experience and a Class B Operator License from the State of Ohio, or be eligible to take the examination for a Class B License. To be classed as an Operator 2, a man needs one year of experience in sewage treatment and a Class C License or must be eligible to take a Class C examination. Those in the Operator 1 class are required to have experience in similar lines of work in industry.

The new employes are selected and started in the organization with the expectation that, through the training programs, they will advance to the higher positions. Job standards and examinations are so prepared as to aid in the selection of the best qualified personnel. The examinations consist of three parts: (1) questions on sewage treatment, math and equipment; (2) questions on supervision abilities, safety; and (3) an oral interview to determine whether a man can think effectively and speak clearly and concisely.

Training of personnel is an important feature of the organization. It involves the use of manuals, slides, 16-mm motion pictures with sound, models, and on-the-job training. Manuals have been prepared for each section of the plant; they contain questions and answers for written examinations during the training period. Answers to the questionnaires serve two purposes:

1. They show whether the instructors are getting the subject matter across to the men.

2. They enable the men to see in what subjects they need further training.

Each new operator is given the book, *Principles of Sewage Treatment*, prepared by the National Lime Association. Slides and still pictures taken during the construction period are used to explain all phases of construction and equipment. Several training films, made with a 16-mm motion picture camera, are accompanied by tape recordings of the instructors' talks so that teachers do not have to repeat their lectures. A model of the plant has been prepared with removable sections in the various structures so that the instructor can show the operators visually just how the plant is put together.

The training course for an operator lasts about 3 weeks, and consists of two half-hour lecture periods in the morning and on-the-job discussions during the afternoon. In addition to the actual courses in sewage treatment, the overall policy in Civil Service regulations is explained in a lecture course. An extensive first-aid and safety course is given. In the training of operators before the Mill Creek plant was in operation, inspection tours were made to the Cincinnati Little Miami Sewage Works. Courses are repeated at intervals so that the men can bring themselves up to date and prepare for the state examination.

Operating equipment

In addition to the permanent equipment installed under the construction contract, the operators must select and have available a number of special units for operation and maintenance.

Because of the extent of the internal railroad system, delivery of alum, tank cars and ton containers of chlorine, and carloads of lime, ferric chloride and fuel oil must be switched around the railroad yards within the property. To handle this problem adequately, a Whiting Trackmobile is used. It has the interesting ability to run, not only on the railroad tracks but, after hydraulic lowering of its pneumatic tires, on plant roads for pulling trailers and performing other services. Personnel considerations were a factor in its selection; any operator or truck driver can use it. For a small diesel switch engine, an operating engineer would have been required.

Cushman motor scooters with special built-in bodies are used by the chief operators and maintenance foremen. Trailers for the scooters are outfitted for special duties—two with fire control equipment, one for heavy welding, and another for hauling sewage and sludge samples to the laboratories.

Another piece of equipment provided is a Fordson tractor outfit, complete with front loader, snow removal equipment, hydraulic backhoe bucket, provisions for hauling, sickle bars for grass cutting, and the like.

There is also a dump truck for hauling ash and a pick-up truck with a hydraulic tailgate for raising drums to the truck body. Dempster Dumpster units are used for hauling grit: enclosed containers are available for trash hauling by the Dumpster units.

Centrifugal and diaphragm pumps, gas and electric driven, in 1-in., 2-in., and 3-in. sizes, are available for dewatering plant areas for inspection and repair. Portable blowers, portable generators and portable light plants have been provided for isolated and emergency use.

The current plan for sewage disposal at Cincinnati is being carried on under direction of C. A. Harrell, F. ASCE, City Manager. The execution of the project comes within the Department of Public Works, W. C. Wichman, Director. T. J. Montgomery, F. ASCE, is City Engineer in charge of the work, and Francis V. Cornelius, Principal Engineer of Construction. Supervision of the Treatment Works, as they are completed, is by A. D. Caster, F. ASCE, Principal Engineer, Sewage Disposal, with an organization appropriate to the functions of administration, accounting, industrial wastes investigations, design and plant operation, and maintenance. Havens and Emerson of Cleveland have been consultants to the city since 1940. Alvin M. Mock, F. ASCE, has been the Consultant's representative since 1950. Small, Smith, Reeb and Draz of Cleveland were associated as Architects on the Mill Creek project.

The civil engineer in fiction

SAMUEL C. FLORMAN, M. ASCE

Vice President, Kreisler-Borg Construction Co.

White Plains, N. Y.

The civil engineer has received abundantly sympathetic treatment from the creative writers of his time. And this should be gratifying to him if he is concerned about how his profession is regarded by the society in which he lives, for it is in the literary marketplace that popular images are both formed and reflected.

But the novelist has more to offer him than praise. If the civil engineer desires to gain a deeper insight into the meaning and the values of the way of life to which he is committed, then the writer of fiction, both directly and obliquely, has much of vital interest to tell him.

Benefactor of mankind

One of the earliest and most celebrated works of fiction about civil engineering is "The Bridge-Builders," a story by Rudyard Kipling (in *The Day's Work*, Doubleday & McClure, 1898). Writing in the time of Britain's glory, just before the turn of the century, Kipling held the firm conviction that a great age of material progress and moral strength was at hand, moving relentlessly to sweep poverty and superstition from the face of the earth. And the civil engineer stands in his story as the symbol of this era.

The scene is set in India, where a great bridge across the Ganges River is nearing completion. It is for the most part the work of one man, a British civil engineer by the name of Findlayson, who has designed the bridge and supervised its construction through three arduous years.

"Findlayson, C. E., turned on his trolley and looked over the face of the country that he had changed for seven miles around. Looked back on the humming village of five thousand workmen; upstream and down, along the vista of spurs and sand; across the river to the far piers, lessening in the haze; overhead to the guard towers—and only he knew how strong those were—and with a sigh of contentment saw that his work was good. There stood his bridge before him in the sunlight, lacking only a few weeks' work on the girders of the three middle piers—his bridge, raw and ugly as original sin, but *pukka*—permanent—to endure when all memory of the builder, yea, even of the splendid Findlayson truss, had perished."

But torrential rains bring a flood

along the Ganges, and the great work is threatened. At the height of the storm, in a scene of wild fantasy, the fabled gods of India appear, bewailing the fact that they have been unable to destroy the creation of the Western intruders. They fear that once the people of India see that their gods are powerless to wreak vengeance on the bridge builders, they will begin to deny their ancient beliefs and place their faith in modern technology. Indeed victory does go to the bridge-builders as, after their Herculean protective efforts, the bridge survives the torrent.

Intelligent, dedicated and tenacious, the civil engineer, to Kipling, is the most admirable of men carrying to the far corners of the earth the banner of the most worthy of civilizations.

This sense of immense beneficial change being wrought by the engineer's triumph over natural obstacles was voiced on the European continent by a Swedish contemporary of Kipling, August Strindberg. "The Story of the St. Gotthard" (in *In Midsummer Days and Other Tales,* Latimer, 1913) tells of the building of a great tunnel through a mountain in Switzerland, which had always separated the German-speaking people in the north from the Italians to the south. The tunnel's completion symbolically links an Italian girl with her German suitor, and heralds the end of the ancient mistrust and hostility between their peoples.

The engineer in charge of construction dies in the tunnel before the work is completed, and is eulogized by Strindberg as a benefactor of mankind. "He ought to have been buried where he fell, in a more gigantic stone pyramid than any of the Egyptian Pharaohs had built for themselves, and his name . . . should have been carved into the stone."

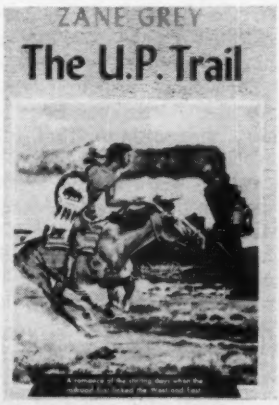
Pioneer

At about the same time, halfway around the world, another noted writer was expressing his admiration for an engineering marvel of even greater dimensions. Robert Louis Stevenson, traveling through the Western United States, encountered the great transcontinental railroad then under construction, and saw in this heroic undertaking the basic material for epic literature.

". . . it seems to me as if this railway were the one typical achievement of the age in which we live, as if it brought together into one plot all the ends of the world and all the degrees of social rank, and offered some great writer the busiest, the most extended, and the most varied subject for an enduring literary work. If it be romance, if it be contrast, if it be heroism that we require, what was Troy to this?"

Stevenson never wrote the great novel of railroad construction he had envisioned, but several American authors undertook to do so. None of these attempts resulted in literary masterpieces but a few were great popular successes, and they did much to etch into the public's imagination a picture of the civil engineer as a heroic figure. Bronzed and lean, outfitted in laced leather boots and a wide-brimmed hat, this young man with a transit invariably seemed to be endowed with the best of all possible traits.

In Zane Grey's *The U. P. Trail* (Harpers, 1918) young engineer Warren Neale is "wild for adventure, keen for achievement, eager, ardent, bronzed-faced and keen-eyed." He is



attached to General Lodge's engineering staff, a group of men who "had been seized by the spirit of some great thing to be, in the making of which were adventure, fortune, fame, and that strange call of life which foreordained a heritage for future generations. They were grim; they were indomitable." Running grades over apparently impossible terrain, battling with Indians on the one hand and corrupt promoters on the other, Neale proudly plays his part in the epic spanning of the continent.

The Winning of Barbara Worth, by Harold Bell Wright (A. L. Burt, 1911), describes the reclamation of Colorado desert country by canal and railroad construction. Three civil engineers figure prominently in the story: the "Seer," a grand old man "still strongly erect and vigorous," whose vision and perseverance are responsible for the project; Abe Lee, a young surveyor scout "made of iron," whose "honesty and loyalty amount almost to fanaticism"; and Willard Holmes, "really a fine looking young man," who comes from New York to represent the financial sponsors of the project. Holmes is an excellent engineer and a polished gentleman, but it takes the discipline of hard work and the ordeal of a dangerous flood to bring out the latent fine elements in his character.

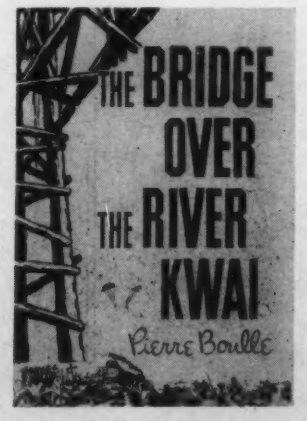
Other robust novels in the same vein are Rex Beach's *The Iron Trail* (Harpers, 1913), Frank H. Spearman's *Whispering Smith* (Scribners, 1906), John Fox Jr.'s *The Trail of the Lonesome Pine* (Scribners, 1909), and Francis Lynde's *The Fight on the Standing Stone* (Scribners, 1925).

Subjected to critical evaluation, these books seem "corny" to us today. The heroes are too righteous and there is everywhere a naive sentimentality which is cloying to the modern taste. Nevertheless these novels have a quality of innocence and romantic exuberance which somehow is capable of re-evoking a time when dedicated men in high-laced boots were leading the conquest of a continent in one of the greatest adventures civil engineering has ever known.

Adventurer

"What was Troy to this?" exclaimed Robert Louis Stevenson, enthralled by the turbulent heroics of pioneering railroad construction. And he might well have said the same about any large construction site, for they all abound in action, danger and excitement. Furthermore, many of these sites are in far-away, undeveloped areas with exotic settings and romantic names.

For example, Eric Ambler's *State of Siege* (Knopf, 1956), a rousing novel of suspense, relates the adventures of an English engineer employed on a dam-building project in Indonesia, and caught up in the midst of an abortive revolution. *The Bridge Over the River Kwai,* by Pierre Boulle (Vanguard, 1954) is another wonder-



fully exciting book in which civil engineers play a leading role, and there are many other tales of action with construction settings.

Matinee idol

If the role of dashing adventurer would seem unlikely enough to the everyday civil engineer, that of great lover would no doubt strike him as even more droll. Yet the fact is that he has proven most appealing to a host of women novelists in search of virile heroes intended to captivate both their heroines and their female readers.

In *Foxfire* (Houghton Mifflin, 1950) best-selling novelist Anya Seton has her young heroine marry an engineer, "very tall" and "lean as a panther," and go to share his spartan life in a Western mining town. She rebels at first, but eventually learns that pretty frocks and gay parties are not as important to her as a solid man with a purpose in life. *Maggie* by Vivian Breck (Doubleday, 1955) tells almost the same story with a Mexican setting, and *The Rock and the Wind*, by Vivien R. Bretherton (Dutton, 1942) also relates the trials and satisfactions of a woman who shares her husband's life on an engineering frontier. Other women who have glamorized the civil engineer include Pamela Hinkson in *Golden Rose* (Knopf, 1944), Ayn Rand in *Atlas Shrugged* (Random House, 1957), Agnes Denforth Hewes in *A Hundred Bridges to Go* (Dodd, Mead, 1950), and Han Suyin in *The Mountain Is Young* (Putnam, 1958).

Fallen idol

However, the civil engineer's skill, purpose and charm failed to overwhelm Willa Cather, who found the inspiration for her first novel, *Alexander's Bridge* (Houghton Mifflin, 1912), not in some notable engineering triumph, but in the calamitous collapse of the Quebec Bridge, which occurred in 1907. She introduces us to the great bridge designer, Bartley Alexander, who seems at first to be cast in a heroic mold.

"When Alexander reached the library door, he switched on the lights and stood six feet and more in the archway, glowing with strength and cordiality and rugged, blond good looks. . . . Under his tumbled sandy hair his head seemed as hard and powerful as a catapult, and his shoulders looked strong enough in themselves to support a span of any one of his ten great bridges that cut the air above as many rivers."

But soon ominous overtones begin to intrude, suggesting flaws behind the imposing facade. Alexander finds that he cannot cope with an inner turbulence, and he drifts into a liaison with an actress which saps his will and threatens to destroy his marriage and his career. He has undertaken a great cantilever bridge in Canada, "the most important piece of bridge building going on in the world," but the "strong and sullen" man within gives him no peace and bids fair to overwhelm him completely. At the crucial point in his personal disintegration, Alexander's great bridge collapses and carries him to his death.

A man, Willa Cather tells us, and by implication a society, may be outwardly strong and materially productive, and yet simultaneously tortured by the darker forces of the human spirit. Such a man, or society, is as inadequately designed as the great symbolical bridge which collapsed so spectacularly into the waters of a Canadian river.

The inadequacy of modern man and of modern technological society is also the theme of *The Great Hunger* (Grosset & Dunlap, 1919), an outstanding novel of great emotional impact. Norwegian author Johan Bojer creates in engineer Peer Holm a protagonist of epic proportions. Reared in crushing poverty, Peer determines to make his mark in the world, and succeeds in becoming a fabulously successful engineer with great works to his credit on several continents. But success and accomplishment bring him only fleeting satisfaction.

"The great evolutionary scheme, with its wonders of steel and miracles of science, goes marching on victoriously, I grant you, changing the face of the world, hurrying its pulse to a more and more feverish peak. But what good will it do the peasant to be able to fly through the air on his wheelbarrow while no temple, no holy day is left him anymore on earth? What errand can he have up among the clouds, while yet no heaven arches above his soul?"

Peer Holm eventually finds peace in the contemplation of man's undaunted spirit, which dwarfs, in Peer's eyes, his material accomplishments.

A Single Pebble by John Hersey (Knopf, 1956) takes the reader on a trip up China's fabulous Yangtse River with a young civil engineer commissioned to select a site for the construction of a great dam. The engineer sets out confident and full of enthusiasm for his project. But as he travels slowly up river with his primitive companions, the awesome weight of centuries-old tradition bears down upon him, until the brash young man's self-assurance begins to waver.

"How could I, in the momentary years of my youth, have a part in persuading these people to tolerate the building of a great modern dam that would take the waters of Tibet and Inner China, with their age-old furies, on its back, there to grow lax and benign? How could I span a gap of a thousand years—a millennium in a day? These people . . . were satisfied, (or so I thought) to exist in Dark Ages, while I lived in a time of enlightenment and was not satisfied."

Kipling's bridge-builder in India had no such philosophical reservations about the value of introducing great engineering works into underdeveloped civilizations. Neither did Kipling feel any uncertainty about the worthwhileness of his hero's devotion to his work, as does Warwick Deeping in "The Great Saaba Bridge" (in *Stories of Love, Courage and Compassion*, Knopf, 1930), a quite different story about bridge-building in India. Deeping's engineer, spurred on by ambition and pride, and haunted by fear of failure, directs his energies to his work with such fervor that his devoted wife is completely shut out of his life. She finally decides to leave him, but at this point he is disabled by an accident, and she dutifully remains by his side. True love is what counts, according to this author, and the engineer obsessed only with material accomplishment has a distorted conception of what is meaningful in life.

The hero of A. Den Doolaard's *The Land Behind God's Back* (Simon & Schuster, 1958) is a Yugoslavian engineer who has designed and constructed a beautiful bridge, the thing most dear and meaningful to him on earth. However, during time of war, he comes to realize that there are principles of greater consequence than his constructive activities, and he eventually destroys his own bridge in the fight to preserve his nation. (This theme is also sounded in *The Bridge Over the River Kwai*.)

It is not overly surprising to find creative artists of sensitivity rebelling against the materialistic emphasis of our society, and subjecting this society's builders to some searching criticism. But paradoxically this criticism contains an element of tribute, since it is in most cases the engineers themselves who discover the shortcomings of their own point of view, proving themselves to be men first and engineers second. There is also admiration implicit in the suggestion that civil engineering is a calling most likely to lure a man into believing that he has found the solution to life's enigmas in the satisfaction and accomplishment of his work.

The civil engineer is usually a serious man engaged in serious work, and as such is poorly equipped to play a comic role. However, there is one notable humorous story about a civil engineer, written by the Russian master, Anton Chekhov, and entitled "Such is Fame!" (Stratford, 1918). The leading character in this story complains to his companion that fame has eluded him.

". . . I am an engineer by profession. I have built a score of wonderful bridges in various parts of Russia, installed water systems in three cities, have worked in Russia, England, Belgium. . . . I'll not burden you with an account of all my services and accomplishments . . . I shall merely tell you that I accomplished far more than many celebrities. And the results? As you see I am already old and ready to die, and I'm just as much known as that black dog running across the tracks over there."

He goes on to tell of the time when he attended the ceremonial dedication of his finest bridge, only to find that nobody in the crowd recognized him. Celebrities of no real worth drew all the attention. He finally observed two men pointing him out, and was pleased to see that at last he had been noticed. Just then he overheard their conversation, and discovered that he was achieving recognition for being the paramour of a third-rate night club singer in town. "Such is Fame!"

The essence of civil engineering

Most of the books considered thus far treat the civil engineer kindly, and some of them are downright laudatory. But we have not yet encountered an outstanding work of fiction that succeeds in capturing the true essence of civil engineering.

H. M. Newell's *The Hard Hats* (Houghton Mifflin, 1955) is a praiseworthy attempt to depict the life of engineers and construction men on a large dam-building project. It has some interesting and pleasant moments, but it does not presume to be anything more than a fine yarn.

The "Ugly American" in the current best seller of the same name (Norton, 1958) is an engineer who exhibits outstanding professional abilities and capacity for understanding the people of a backward nation. But he is a little too perfect to seem real.

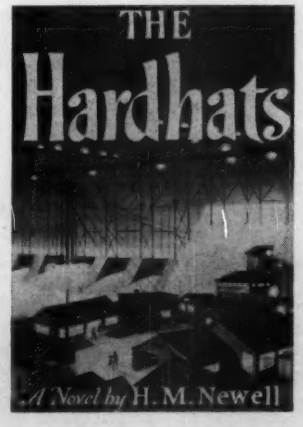
There is one book, however, which stands out in brilliant contrast to all the others. Appropriately it is written about, and by, a citizen of that land to which civil engineering is the very life blood—The Netherlands. This is *Roll Back the Sea* (Simon & Schuster, 1948) and its author is A. Den Doolaard, who also wrote *The Land Behind God's Back* previously discussed. *Roll Back the Sea* tells the story of the Dutch *Waterstaat* engineers who rebuilt the dikes at Walcheren, destroyed during World War II. This is no swashbuckling tale of daredevil heroics. Chief Engineer van Hummel comes alive as a quiet, somewhat shabby little man, but possessed of an inner strength that is the mark of the true hero. His associates also have human shortcomings and human virtues which make them genuinely credible characters. His wife is not a scintillating beauty, but a good, solid woman with a warm understanding of the gratifications and tribulations that go with being married to an engineer. His only adversary is that greatest of all adversaries—brute nature.

This stirring novel encompasses all that civil engineering can be—the drama and excitement, the challenge and responsibility, the perseverance and dedication, the creative satisfaction, and above all, the sense of ultimate fulfillment found in constructive accomplishment.

The quest

Of all the great literary works dealing with man's quest for the answers to life's mysteries, none is more famous than Goethe's poetic drama *Faust*. The plot of Part I of this classic is universally familiar. In it Faust wagers his soul with the devil that he will never experience a moment so satisfying that he will say, "Ah, linger on, thou art so fair!" Mephistopheles tempts him with youth, knowledge, magical powers and other assorted pleasures, including the most beautiful and pure of women, but Faust cannot shed his discontent.

Part II, which was written in the wisdom of Goethe's old age, and published after his death, is not nearly so well known as Part I. In it Faust does at last find the moment he has been seeking all his life. He experiences this moment of absolute contentment while participating in a dike-building and land-reclamation project! One literary critic has commented that "to some readers it may seem strange and even flat that Faust should find his highest happiness in a more or less prosaic engineering project." But Goethe's solution to the dilemma of his epic hero stands for all to read and ponder. Although in finding his moment of complete satisfaction Faust loses his bet with the devil, his soul is saved, since "whoever aspiring, struggles on, for him there is salvation."



A similar philosophical conclusion is suggested in Franz Kafka's *The Castle* (Knopf, 1930) a modern allegory of man's eternal search for heavenly grace. Kafka's protagonist, "K," strives mightily to attain recognition from the mysterious mountaintop "Castle." The reader soon discovers that salvation for "K" hinges on his obtaining from the Castle confirmation of his appointment as land surveyor. Like Goethe, Kafka suggests that the best solution to life's inscrutable mysteries may be found in such an honest and productive calling as civil engineering.

The future

Clearly the civil engineer has reason to be gratified by the image of himself which he discovers in the world of fiction. The hostility the businessman complains of has certainly not been directed against him. But, on the other hand, he has not received anything like the attention that serious writers have devoted to the businessman—and, one might add, to the doctor, the lawyer, the farmer, the artist and the politician. This is particularly true in America. Of the authors of literary stature who have been mentioned in this study, consider how few are Americans. Goethe was German; Kafka, a Czech; Chekhov, Russian; Pierre Boulle, French; Doolaard, Dutch; Strindberg and Bojer, Scandinavian; and Kipling, Ambler and Deeping, English.

Perhaps in the years to come, as our society slowly changes, as it must, from a business orientation to a technological orientation, the important American writers will turn increasingly to the engineer as a character for meaningful fiction. The civil engineer must then be prepared for somewhat harsher treatment than he has received heretofore. But to the extent that future authors shed light—no matter how searching—on any facets of the civil engineering experience, their contributions should be welcome.

RIGHTS in underground waters

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Legal rights to underground waters in Ohio recently were investigated for a municipality which was contemplating the acquisition of a large new well supply some miles from its borders. Ohio does not control the use of underground waters by statute. This is generally true of states east of the Rocky Mountains, in contrast with the arid Western states in which such rights have been more clearly defined by law and custom. This paper is concerned with general rights to underground waters rather than with the established right of a public agency to take property by condemnation for the public good.

In the absence of statutes relating to rights in underground waters, court decisions in Ohio and states whose rulings might influence Ohio courts, were reviewed. In an old case, *Frazier v. Brown,* brought before the Ohio Supreme Court in 1861, the court decided that the so-called "English rule" as to underground percolating waters applied. The Court said:

"In the absence of express contract and positive legislation, as between proprietors of adjoining lands, the law recognizes no correlative rights in respect to underground waters percolating, oozing or filtrating through the earth; hence, where a land owner digs a 'hole' on his own land for purposes connected with the use of his own land, thereby cutting off or diverting underground waters which have always been accustomed to percolate and ooze through his land to the land of an adjoining proprietor, and there to form the source of a spring and rivulet, any damage thereby occasioned to such adjoining proprietor is *damnum absque injuria.*" (Syllabus 1)

The reasons assigned for the rule were:

"1. Because the existence, origin, movement and course of such waters, and the causes which govern and direct their movements, are so secret, occult and concealed, that an attempt to administer any set of legal rules in respect to them would be involved in hopeless uncertainty, and would be, therefore, practically impossible.

"2. Because any such recognition of correlative rights, would interfere, to the material detriment of the common wealth, with drainage and agriculture, mining, the construction of highways and railroads, with sanitary regulations, building and the general progress of improvement in works of embellishment and utility."

The originator of this rule, *Acton v. Blundell,* decided in England in 1843, (12 Mees. & W. 324) employed an even broader theory, namely that ownership of land "gives to the owner of the soil all that lies beneath his surface; that the land immediately below is his property, whether it is solid rock, or porous ground, or venous earth, or part soil, part water; that the person who owns the surface may dig therein, and apply all that is there found to his own purposes at his free will and pleasure; and that if in the exercise of such right, he intercepts or drains off the water collected from underground springs in his neighbor's well, the inconveniences to his neighbor falls within the description of *damnum absque injuria,* which cannot become the ground of any action."

In plain language, the English rule seems to be that God rewards the man with the biggest pumps.

Rulings in other states were examined to determine whether the announced adoption in Ohio of the "English rule" could be considered reliable. We assembled all the reported cases involving the diversion of percolating waters and found that, beginning in New York around 1900, there was a widespread trend toward substituting for the old English rule what might be termed "the reasonable use" rule. This is, in essence, a determination that there are limits to the English rule. The limit is reached when a land owner extracts the underground percolating water for uses other than reasonable use on his own premises, that is, specifically, when he extracts these waters for transportation and sale or use elsewhere. An important point is that this limitation was developed in important jurisdictions such as New York and Pennsylvania, which previously had apparently accepted the English rule.

In the case of *Forbell v. City of New York,* decided in 1900 in the New York Court of Appeals (58 N.E. 644), it appeared that the plaintiff was a lessee of farm lands in Kings County on which he grew celery and watercress. On a two-acre tract near the plaintiff's lands, the city constructed a pumping station and drilled wells, the waters from which were piped to the city for sale. It was found that this exhausted the plaintiff's land of its accustomed and natural supply of underground water and prevented him from growing his crops. Plaintiff was granted a perpetual injunction restraining the city from operating its wells and pumping station and awarded $6,000 past damages, since the trial judge found that the city's acts constituted a trespass. In affirming the judgment, the Court of Appeals, after citing *Acton v. Blundell, supra,* and earlier New York decisions, stated:

"It may be conceded that these reasons, or some of them, were ample to afford the proper rule of decision in the cases to which they were applied. We do not intend to impair their applicability to like cases. But there are features of this case to which these reasons do not apply. As already intimated, the defendant installed its pumping plant knowing that the underground operation and habit of this store of water in its own and neighboring lands, including the plaintiff's, a total area of from five to eleven square miles, would enable it to capture the greater part of it. . . . It is not unreasonable, so far as it is now apparent to us, that he should dig wells and take therefrom all the water that he needs in order to the fullest enjoyment and usefulness of his land as land, either for purposes of pleasure, abode, productiveness of soil, trade, manufacture, or for whatever else the land as land may serve.

He may consume it, but must not discharge it to the injury of others. But to fit it up with wells and pumps of such pervasive and potential reach that from their base the defendant can tap the water stored in the plaintiff's land, and in all the region thereabout, and lead it to his own land, and by merchandising it prevent its return, is, however reasonable it may appear to the defendant and its customers, unreasonable as to the plaintiff and the others whose lands are thus clandestinely sapped, and their value impaired." (pp. 645-6)

Concluding, the court said:

"We recognize the fact that the water supply of a great city is of vastly more importance than the celery and water cresses of which the plaintiff's land was so productive before the defendant encroached upon his water supply. But the defendant can employ the right of eminent domain, and thus provide its people with water without injustice to the plaintiff." (p. 646)

This rule has subsequently been acknowledged and followed (not always without some confusion as to remedy granted) under similar circumstances in Minnesota, New Jersey, Michigan, North Carolina, Pennsylvania, Nebraska, Oklahoma and Florida. An excellent statement of the "reasonable use" rule is contained in the Oklahoma Supreme Court's opinion in *Canada v. City of Shawnee* (64 P. 2nd 694) decided in 1936:

"Stated generally, the rule of reasonable use is that each landowner is restricted to a reasonable exercise of his own rights and a reasonable use of his own property, in view of the similar rights of others. This does not mean that there shall be an apportionment of subterranean percolating water between adjacent landowners, for such a thing is often, if not always, impossible, and it was this same impossibility which gave rise to the English rule itself. . . .

"It clearly appears from the cases that the American rule is used merely as a check upon the unreasonable use of the English rule; that few if any cases can be found where American courts have denied a landowner the right to draw as much percolating water from under his land as he needs, even though it hurts his neighbor, so long as the use to which he puts it bears some reasonable relationship to the natural use of his land, and even though such use of the land be industrial and not agricultural. But the majority of recent decisions stop short at and forbid the harmful extraction of percolating water for sale at a distance."

We have found only three states in which their respective Supreme Courts have, in recent years, reviewed both rules under a transportation and sale situation and have determined to adhere to the English rule. These are Wisconsin (*Menne v. City of Fond du Lac*, 77 N.W. 2nd 703, 1956), Connecticut (*Hartford Rayon Corp. v. Cromwell Water Co.*, 10 A. 2nd 587, 1940), and Vermont (*Fire District No. 1 v. Graniterville Spring Water Co.*, 152 A. 42).

Up to this time the Ohio courts have never had that situation presented. In other words in all the Ohio decisions the use that caused the alleged damage was merely a use or development of the land owned, as by mining, drilling a gas well, construction of a sewer, deepening a river channel; and the result—denial of any recovery to the injured plaintiff—would have been reached under either the English rule or the reasonable use rule (*Frazier v. Brown*, 12 O.S. 294; *Elster v. Springfield*, 49 O.S. 82; *Ohio Collieries Co. v. Cocke*, 107 O.S., 238; *Logan Gas Co. v. Glasgo*, 122 O.S. 126; In Matter of Miami Conservancy District, 25 O.N.P.N.S. 325). It is our best guess that when a transportation and sale situation comes along and the chips are down, the Ohio courts will fall in line with the weight of authority and employ the reasonable use rule.

What is the "reasonable use" which this rule protects against adverse claims? If extraction for transportation and sale or use elsewhere is an "unreasonable use," who may call the unreasonable user to account?

Farmers and growers have been protected, whether they depend on wells or springs or on subsoil irrigation, as against extraction by public bodies for transportation and distribution, away from the well site, where the adverse effect of the latter on the former is duly demonstrated (*Forbell v. City of New York*, 58 N.E. 644, N. Y. Ct. of App. 1900; *Rouse v. City of Kinston*, 123 S.E. 482, N. Car. Sup. Ct. 1924; *Koch v. Wick*, 87 So. 2nd 47, Fla. Sup. Ct. 1956; *Katz v. Walkinshaw*, 70 P. 663, Cal. Sup. Ct. 1902; *Meeker v. City of East Orange*, 74 A. 379, N. J. Ct. of E. and A. 1909).

A hotel using its own well water, with medicinal qualities, to supply its premises, was protected against diminution caused by a later drilled city well for general city supply (*Bernard v. City of St. Louis*, 189 N.W. 891, Mich. Sup. Ct. 1922).

A manufacturer who uses his well to make large quantities of ice used in storing his product and readying it for shipment was protected, as a reasonable user, against a neighboring farmer whose farm supply was adversely affected by the heavy withdrawal for ice-making purposes (*Dunbar v. Sweeney*, 130 N.E. 913, N. Y. Ct. of App. 1921).

To conclude, let us take the hypothetical case of a municipality, badly in need of more water, which has discovered a fine underground supply some miles away. Thanks to the great increase in engineering knowledge, its consulting engineers can advise with accuracy the extent of the underground reservoir, how fast it is likely to be replenished, and what effect a given rate of pumping by the city will have on the level throughout the reservoir. With this reliable prediction the officials and engineers begin investigating the surrounding lands to make an informed guess, based on the uses to which they are now being put, on how such uses will be affected.

If the adjacent owners are farmers and their land will be made arid, it probably will be better to buy them up immediately than to be forced later to condemn. If the only effect will be to lower the level in existing wells, then the city may merely have to pay the cost of deepening the wells. If the underground source feeds and maintains a stream, repercussions may come from riparian owners. Perhaps the cheapest solution will be for the city, in times of abnormally low flow, to pump some of its water back into the stream.

If this underground source is already being used for a well water supply by the Village of X, which likewise has the power of condemnation, the situation is one that the cases have not covered. If the village well is within its corporate limits, perhaps the village can enjoin the city from doing anything that will substantially affect adversely the present village supply. If the village well, like the city's, is outside its corporate limits, then they are both transporters and sellers of water but the village was doing it first. Frankly I cannot guess the legal answer, but my advice to the city in either situation would be to work out a deal with the village before investing a lot of money in wells, pumps and pipelines and taking a chance in court. Until, presumably by legislation, public rules of apportionment have been laid down, a private rule of apportionment by contract will have to be devised to take care of such situations.

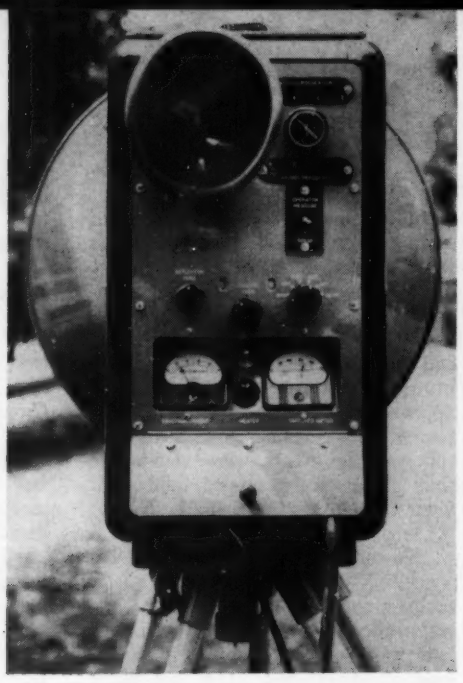
(This article was prepared from the paper Mr. Gates presented at the ASCE Cleveland Convention, before the Sanitary Engineering Division session at which Arthur D. Caster, Secretary of the Division's Executive Committee, presided.)

WHAT'S NEW..

IN SURVEYING INSTRUMENTS

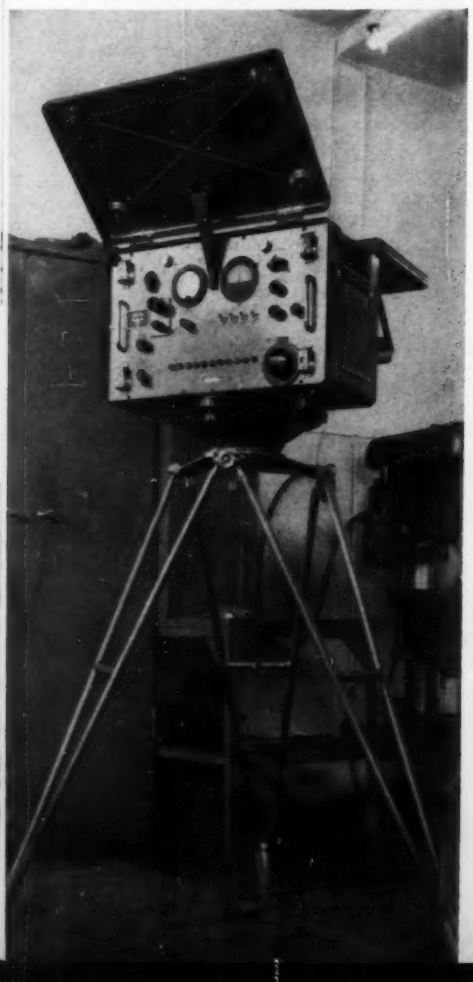
ROLAND H. MOORE, F.ASCE, Assistant Chief Topographic Engineer

U. S. Geological Survey, Washington, D. C.



In measuring distances with the Tellurometer, the known velocity of radio waves is used. Photo, USGS.

The known velocity of light is utilized in measuring distances by the Geodimeter. Photo, Berg, Hedstrom and Company, Inc.



The revolution in photogrammetric and surveying instruments and techniques has profoundly affected the personal life of many surveyors. Precise aerial photography and ingenious stereoscopic plotting instruments now make it possible to produce high-quality maps in the comfort of air-conditioned offices far removed from the site being surveyed. Thus, many a surveyor who in the old days would have roamed the wide open spaces, is today a city dweller. Yet more field surveying is being done today than ever before, because more mapping is being done. In the past ten years, for example, the Geological Survey has doubled its annual output of mapping.

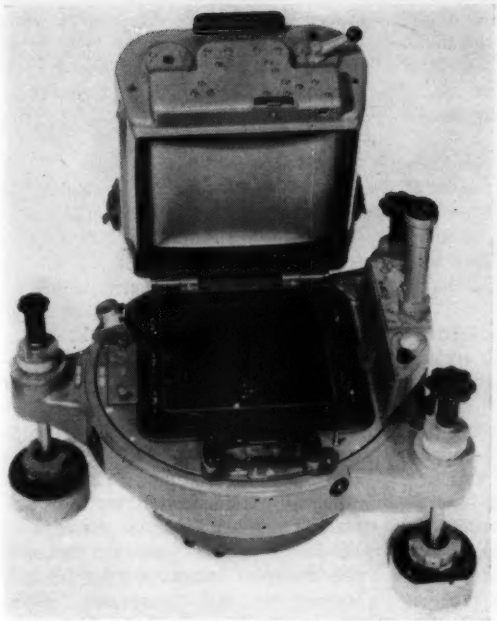
An interesting sidelight is that, in spite of the considerable rise in the cost-of-living index, the cost per square mile of mapping has not risen during the past ten years. This can be attributed, at least to some extent, to improved instrumentation and more efficient techniques. The new instruments and methods not only have lightened the physical tasks of the surveyor but also have increased production, maintained accuracy, and decreased cost.

Measuring distances

The problem of obtaining accurate and economical distance measurements for triangulation base lines and for traverse courses has long been a "tough nut" for the surveyor to crack. And only within the past few years has a real breakthrough occurred, with the introduction of new instruments employing wave mechanics and electronics.

The first of these developments is the Geodimeter, which employs a modulated light beam directed from apparatus set up at one survey station to a reflector set up at a second station. The distance between the two stations is determined as a function of the phase difference between the emitted beam and the reflected beam, and the precise value of the velocity of light. The system requires clear weather, darkness, and an unobstructed path between the two stations. Distances up to 25 to 30 miles have been measured with an accuracy good enough for geodetic base lines. For Model 2, the manufacturers claim an accuracy of 1 to 2 parts per million for distances of 10 to 30 miles. The Geodimeter also gives good results for short distances. It is not affected by moving or stationary objects in the vicinity of the stations or the sight-line.

Soon after the introduction of the Geodimeter, another valuable distance-measuring device, the Tellurometer, became available. The Tellurometer, in effect, utilizes a modulated radio signal transmitted from a master unit set up at one survey station and received and retransmitted by a remote unit set up at a second station. The phase of the return signal is compared with that of the initial signal,



One of the most recent developments in aerial photography is the super-wide-angle camera. The Wild RC-9 automatic film camera here shown is equipped with the super-wide-angle Super-Aviogon f 5.6 lens, which has an angular field of 122 deg and excels in sharp detail and favorable distribution of illumination. Photo, Wild-Heerbrugg.

and the distance is derived from the phase difference and the known velocity of radio waves.

The Tellurometer can be operated by day or night; it can penetrate haze, smoke, fog, clouds, and light rain, and even a limited amount of foliage or timber if the obstruction is not too near one of the stations. At an optimum distance of 10 to 25 miles it has an inherent accuracy of 1 part in 300,000, plus or minus two inches, the two inches being independent of distance. Distances of 40 or more miles can be measured under favorable conditions. The Tellurometer is less accurate for distances of less than one mile. The system is affected by reflections from nearby moving objects, such as people, vehicles or waving grass. Although some occasional "bugs" in the system have been encountered, a year of experience by the Geological Survey indicates good results. (See article by E. J. Jones, in CIVIL ENGINEERING for July 1959.)

The most recent development in this field, known as Micro-Dist, operates on the same basic principle as the Tellurometer but differs from it in detail. Micro-Dist readings are taken from a direct-reading counter instead of from a cathode-ray tube. Another big advantage is that the master and remote units are interchangeable. Accurate measurement of relatively short distances is possible with the Micro-Dist, which is also effective for distances up to 50 miles.

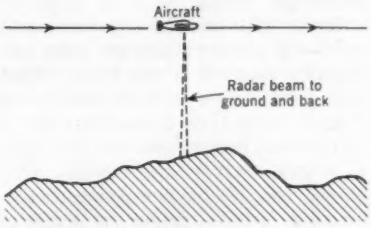
The traditional method of determining differences in elevation by differential leveling is still the practice, although the more efficient devices operating on the pendulum principle are fast replacing the spirit level. Pendulum-type devices are also replacing spirit levels on telescopic alidades, and to some extent on theodolites.

Measuring elevation

Here too, the science of electronics offers opportunities for new solutions to old problems. The improved elevation meter has come to the front again as an economical means of establishing fourth-order vertical control. The equipment is mounted in a carryall truck specially modified with four-wheel steering. As the apparatus proceeds along a road, a very sensitive free-swinging pendulum cuts an electromagnetic field so that an electrical signal is generated whose strength is proportional to the sine of the angle of slope. Another electrical signal is generated by a revolution counter connected to a special fifth wheel which measures the distance traveled. By means of an electronic integrator, the two signals are combined into a continuous and automatic record of the difference of elevation from an initial starting point.

To eliminate dynamic effects, the vehicle must be stopped to take elevation readings. When proceeding at moderate speeds over readily passable roads, the elevation meter can produce about 50 to 100 miles of leveling a day, reliable within 1 or 2 ft, more or less, depending on operating techniques and distances between controlling bench marks. The elevation meter should be particularly economical on large projects where there is an adequate road network.

Another electronic development for determining elevations, the radar altimeter, measures variations in the height of terrain by emitting a radar beam from an airplane traveling at a constant pressure altitude. The beam bounces off the ground, back to the air-borne radar equipment. The terrain clearance (height of the airplane



above the ground) is measured as a function of the elapsed time; the ground elevation is determined from the altitude of the airplane and the terrain clearance. Critical problems in the radar altimeter system are not only the accuracy of the radar measurements but also the stabilization of the datum to which the terrain clearances are referred in determining the ground elevations. Continuing improvements in the equipment and techniques for radar altimetry, particularly in Canada, make this a potentially valuable tool for use in small-scale mapping.

Adjusting field surveys

The remarkable development of electronic computers has opened the way to the elimination of tedious computations for adjusting field surveys. To take advantage of the vast potential of electronic computation, programs have been prepared, in particular, by the Coast and Geodetic Survey using IBM equipment; by the Geological Survey using the Datatron; and by the Army Map Service using Univac.

Aerial photography is unquestionably the factor that has had the most far-reaching effect in revolutionizing surveying practices. Since aerial photographs are the basis of a whole chain of operations in surveying and mapmaking, it is essential that the geometry and photographic quality of the aerial exposures meet the highest possible standards. To this end, engineers

have been constantly examining and reexamining the basic factors of photography—focal length, negative format, angle of coverage, lens distortion, resolution, film flatness, camera combinations and orientations, camera calibration, and tilt control, to name a few.

Some excellent aerial cameras are now available for precise mapping, notably the Fairchild T-12 Planigon, the Wild Aviogon and the Zeiss Pleogon. These are high-resolution, low-distortion, wide-angle cameras developed to their present state of excellence in the past few years.

The latest thing in aerial photography, the super-wide-angle camera, became available only this year. Super-wide-angle lenses, with an angle of coverage of some 122 deg (compared to 93 deg for the Planigon), were successfully designed in the Soviet Union and produced in a series known as Russar. Since then a manufacturer in Switzerland has entered this field. The Geological Survey has recently purchased two Wild Super-Aviogon cameras and is investigating the design of compatible instrumentation for plotting with super-wide-angle photography.

We are now and again faced with crash programs. Suppose, for example, we were suddenly faced with an order to quickly map vast areas in arctic regions. Here are some of the kinds of equipment, already developed, that might be used:

The P.P.I., or *plan position indicator* radar system, produces a series of consecutive photographs of the radarscope, which is aimed straight down, as the plane proceeds along the flight tracks. It is quite reliable for scale and position but poor in resolution qualities. It is suitable for making small-scale reconnaissance maps.

Photographs made from *side-looking radar* (aimed out either side of the plane) afford much well-resolved detail, but the scale is not uniform. These photos must be correlated with the P.P.I. radar to obtain a reliable scale.

The *radar altimeter* as described above, is useful for developing vertical control for reconnaissance mapping.

Any of several *electronic tracking systems*, such as Shoran, Hiran, Raydist, or Decca, can be used to determine the distance of each exposure station from a fixed ground base or to keep the aircraft on a predetermined flight path. Each of these systems requires both air-borne and ground installations, and the range is limited.

Another system for determining an aircraft's position along a given flight track, the *Doppler system*, is entirely air borne. By measuring the frequency shift in a radar signal reflected from the ground, it derives the distance traveled by the aircraft during the elapsed time. This is integrated to give a continuing log of distance traveled, which can be correlated with aerial photographs. The big advantage is that no ground stations are required.

Various *inertial guidance* systems are available in which extremely sensitive gyro systems are integrated with servomechanisms to keep an aircraft on a predetermined course. This is especially important for photographic flights over featureless expanses of ice and snow.

Control extension

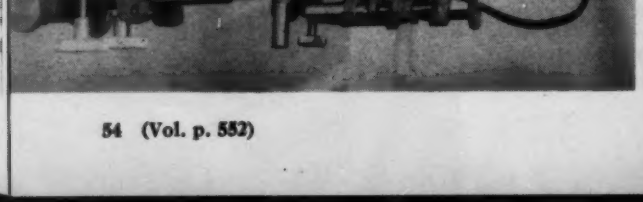
A key factor in the economy of photogrammetric mapping is the ability to extend the relatively sparse control obtained in the field to provide adequate control for each model. (A model is the overlapping portion of two adjacent photographs.)

The ER-55 projector, known commercially as the Balplex, has proved to be a very versatile instrument for aerotriangulation as well as for compilation. It can be used for bridging (orienting overlapping portions of adjacent photographs) vertical, low-oblique, or high-oblique photographs. ER-55 projectors form the heart of the Twinplex instrument for bridging convergent and transverse photographs.

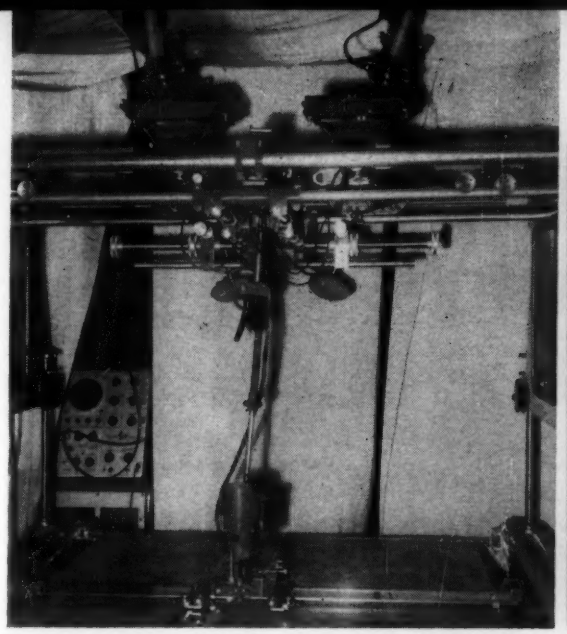
A three-projector Kelsh instrument has just been placed on the market, permitting a two-model bridge. This instrument may prove especially useful to surveying firms engaged in large-scale limited-area work, where a moderate amount of control extension is desirable.

Although numerous mechanical refinements have been made in first-order plotters, such as the Zeiss C-8 Stereoplanigraph and the Wild A-7 Autograph, the big news about plotters of this type lies in their linkage to systems for electronic-computer analysis of the results. These plotters can now

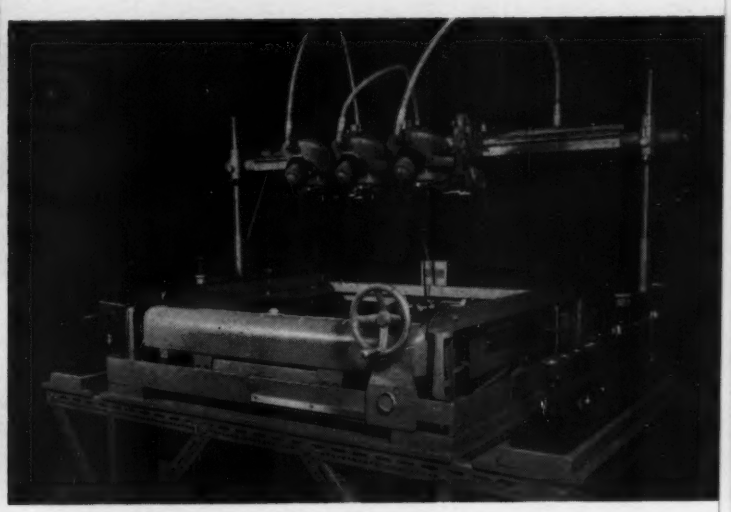
A versatile instrument for both aerotriangulation and compilation is the ER-55 projector (Balplex), which can be used for bridging vertical, low-oblique, or high-oblique photos. Photo, USGS.



This three-projector Kelsh instrument permits a two-model bridge and is of special value to firms engaged in large-scale limited-area work, where a moderate amount of control extension is desirable. Photo, Kelsh Instruments Corporation.



The Stereomat, an electronically activated plotting instrument, will perform automatic profiling and semi-automatic contouring. Other uses are in highway cross-sectioning and the computation of earthwork quantities. Photo, Benson-Lehner Corp.



With the Orthophotoscope, a uniform-scale photograph, with no distortions due to tilt and relief, can be provided. This device combines the scale reliability of a map with the wealth of detail afforded by a photograph. Photo, USGS.

be purchased complete with an output system which will deliver x, y, or z coordinates of points on punched cards or tape, ready to be fed to a computer for adjustment of aerotriangulation.

An effective and simple means of extending horizontal control is the stereotemplet system. In this system, a stereoscopic model is the basis for preparing a dual templet having an adjustable scale. Errors due to tilt and relief are eliminated by the stereoscopic method of preparation. The stereotemplets are assembled and adjusted in the same way as monoscopic templets.

In a new method for adjusting aerotriangulation, devised by Dr. Hans Jerie, a mechanical analogue is used to set up stresses in proportion to discrepancies between values derived independently for point coordinates. The principle of least work is used to obtain a solution that is mathematically analogous to a least-squares solution.

The solution of the photogrammetric problem of aerotriangulation by completely analytical means is a project of formidable magnitude. Although no operational system has been completed, tests of experimental systems have been encouraging. Such a system, when completed, will require a stereocomparator built to the highest standards as well as a large-size electronic computer.

Major manufacturers of photogrammetric plotting instruments are constantly improving their products and introducing new models. We cannot hope here to catalog all the recent improvements. Mention should be made, however, of two or three items that are off the beaten path.

New plotting instruments

A long step towards real automation has been taken with the building of an electronically activated plotting instrument known originally as Auscar and now called the Stereomat. The Stereomat will perform automatic profiling and semi-automatic contouring. Other uses are in highway cross-sectioning, preparation of terrain models, and computation of earthwork quantities. This apparatus combines a direct double-projection anaglyphic instrument with x and y cross-slides and an electronic sensing device in the tracing table. The device actually senses parallax in the model and appropriately adjusts the projectors so that they attain pretty good relative orientation. This equipment, invented by Gilbert L. Hobrough, of The Photographic Survey Corporation, Ltd., Toronto, Canada, is being further developed by the Benson-Lehner Corporation in the U. S.

The highway engineering field has been greatly stirred by the recent adaptation of mapping equipment to earthwork computation. In this system, a Kelsh plotter is used in combination with an electronic computer. Position and height readings of points on a highway cross-section (or profile) in a Kelsh plotter terrain model are fed to the computer, which has been programmed to convert these readings to volume computations.

The recent development of the Orthophotoscope by the Geological Survey has provided a means of producing something long desired by the surveyor—a uniform-scale photograph with no distortions due to tilt and relief. These orthophotographs combine the scale reliability of a map with the wealth of detail afforded by a photograph.

A somewhat similar development is the photo-contour map. This product, available commercially, consists of a uniform-scale photograph with contours superimposed in the proper position.

Surveying instrumentation is in a state of rapid and continual change. One does not have to be very daring to predict that there will be changes in the near future that are not dreamt of now. Makers and users of surveying instruments have some tough problems coming up in the Space Age, but judging by past experience they will be ready with the needed ideas and know-how. If we peek into the crystal ball, we can see some things that may be just around the corner, such as equipment for establishing control without ground surveys; instruments and methods for mapping the ocean bottom; and equipment and techniques for mapping the moon, the sun, the planets and outer space.

(This paper by Mr. Moore was originally presented at the ASCE Cleveland Convention, before a session of the Surveying and Mapping Division and the Highway Division, presided over by Milton O. Schmidt, Chairman of the former Division.)

PRESTRESSED CONCRETE CYLINDERS FOR TWO BREAKWATERS

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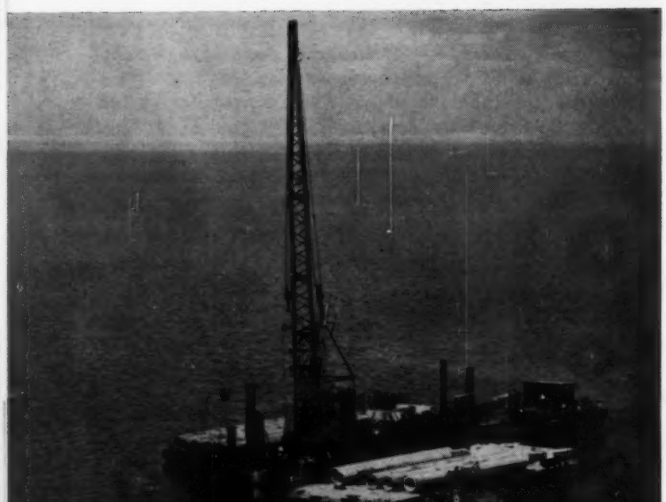
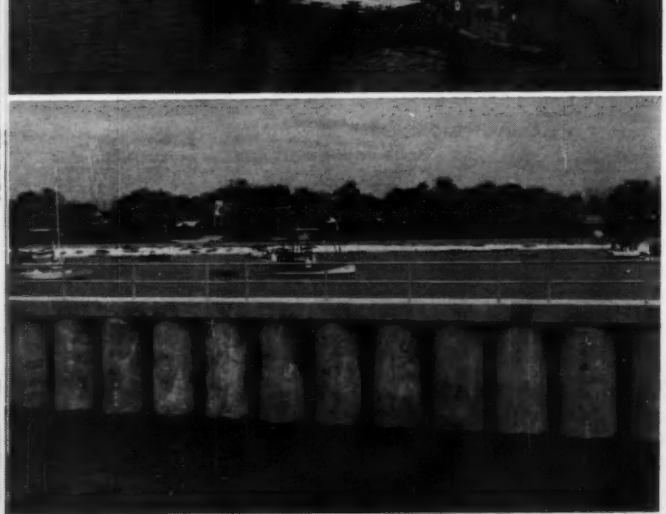
Prestressed Concrete Representative, Gulf of Mexico Area

Raymond International, Inc., New Orleans, La.



Prestressed cylinders and cap beams for Pass Christian Breakwater were fabricated some 80 miles from job site and brought in by barge.



Creosoted timber fillers for Pass Christian Breakwater were driven into Gulf bottom and fastened together in opposing pairs by galvanized bolts before caps were placed.

Lake Pontchartrain Breakwater, 350 ft long, is in relatively shallow water 3 to 6 ft deep, with top of wall 4.5 ft above mean water level. Precast cylinder piles are 32 ft long.

Precast prestressed concrete cylinders cast in one piece and driven like piles in a row close together have been used for two breakwaters in the Gulf of Mexico area. These structures are unique in several respects. They are self-supporting during construction, even under adverse storm conditions; the construction time is extremely short; and their in-place cost is low. The first of these two breakwaters is located in Lake Pontchartrain near New Orleans, La. The second was built in the Gulf of Mexico offshore from Pass Christian, Miss., to provide a small-boat basin.

To build these breakwaters, the precast prestressed cylinder cells were first driven into the lake or Gulf bottom. Then the space between them was filled with a suitable material, either timber or concrete, and a sectional precast cap beam was placed on top of the cells. This cap beam is tied to the individual pile cells and the sections of cap are tied together to provide continuity along the entire wall. The cap beam also serves as a walkway, providing access to the breakwater and also serving as a fishing pier.

The prestressed concrete cylindrical cells utilized in the breakwater construction have an outside diameter of 54 in. and are prestressed longitudinally by twelve post-tensioned bonded cables each consisting of twelve wires of 0.192-in. diameter, initially stressed to 150,000 psi.

Fabricated by Raymond International, Inc., at Mandeville, La., the cylinders

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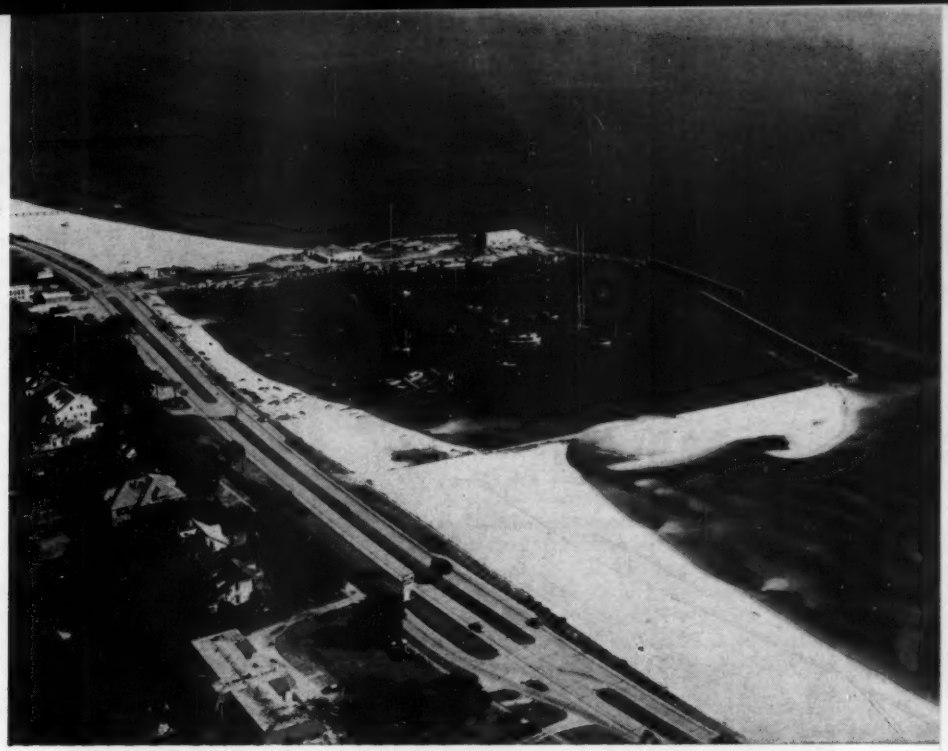


Breakwater at Pass Christian, Miss., in Gulf of Mexico, provides a basin for small boats. Entrance is about 75 ft wide and about 10 ft deep.

nd cap beams were barged from the plant to the job sites, a distance of some 80 miles in the case of the Pass Christian breakwater and 30 miles for the Lake Pontchartrain structure. These cellular piles were placed by driving with a Raymond No. 4/0 single-acting steam hammer developing a rated energy of 48,750 ft-lb per blow. The piles were driven on 5-ft centers leaving a clear space between piles of 6 in. The opening between piles accommodates creosoted timber sheetpiles, 10 in. x 10 in., chamfered to fit the curvature of the cellular concrete piles. Two timbers are placed at each opening, one on each side of the wall. Each pair of opposing timbers is drawn tight together by galvanized bolts. Before the precast cap beam is placed, the cells are filled with sand to a point 2 ft 6 in. below the top. This sand increases the pile's rigidity and serves as the support for cast-in-place concrete, which is poured into the pile through holes left in the precast cap, thus providing a rigid connection between pile and cap. Cap sections are joined by lapping and welding reinforcing steel and pouring a concrete joint. An aluminum or galvanized handrail completes the installation.

Design of the breakwaters took into consideration vertical load, erosion factors, and lateral loading conditions. The vertical load per pile consists of a cap load of about 600 lb plus the dead load of 850 lb per ft of pile. On the basis of the worst soil conditions, which were encountered on the Pass Christian project, a pile embedment of 20 ft was assumed. Based on this penetration, an ultimate carrying capacity per pile of approximately 51 tons (as compared with an actual pile load of 18 tons) resulted in a factor of safety against bearing failure of the pile of 2.8.

An existing breakwater (adjacent to the new Pass Christian breakwater) was driven to a penetration of less than 20 ft but has not eroded over the past several years. For this reason, erosion effects were neglected in the new design. This assumption seems to be justified by those parts of the breakwater that have now been exposed to wave forces in the Gulf for one year without showing any measurable erosion.

Lateral loading conditions are governed by the maximum wave condition to be expected. Data furnished to the designers indicated a maximum wave height of 8 ft at Pass Christian. Using the Sainflow method for analyzing wave force, the total lateral wave force per pile was determined to be about 19,000 lb. The net soil pressure per pile is about 107,000 lb, indicating a factor of safety of 5.6. Although this safety factor seems high, it should be remembered that the design calculation included various uncertainties and assumptions, and also that the impact factor and scour considerations were either neglected or minimized. Thus any reduction in the embedment of piles would not have been warranted.

The Lake Pontchartrain Breakwater is in relatively shallow water, 3 to 6 ft deep, and the top of the wall is 4.5 ft above the mean water level. A 6-ft storm tide was assumed and then a 3-ft wave on top of the tide. The foundation soil consists of a dense white sand layer extending to a depth of some 50 ft below the lake bottom. The low bid for this 350-ft-long breakwater, based on piles with an outside diameter of 54 in., 32 ft long, was $186 per lin ft of breakwater in place, that is, for the prestressed cylinders, the creosoted timbers and the precast concrete cap.

The Pass Christian project is in water 8 to 12 ft deep and the top of the wall is 11 ft above mean Gulf level. Soil borings taken at the site indicate a soft mud bottom varying in thickness from 1 ft to 8 ft. The mud is underlain by a stratum of medium sand 25 ft thick.

The 975-ft Pass Christian Breakwater was bid in place for $205 per lin ft of breakwater based on piles of 54-in. outside diameter, 40 ft long. This price included the cylinder piles, the creosoted timber fillers, the precast concrete cap, and the galvanized handrail. Of interest is the fact that the prestressed cellular design for the Pass Christian breakwater was bid competitively with two alternate designs, one based on a steel sheetpile design and one on a riprap or rubble-mound design.

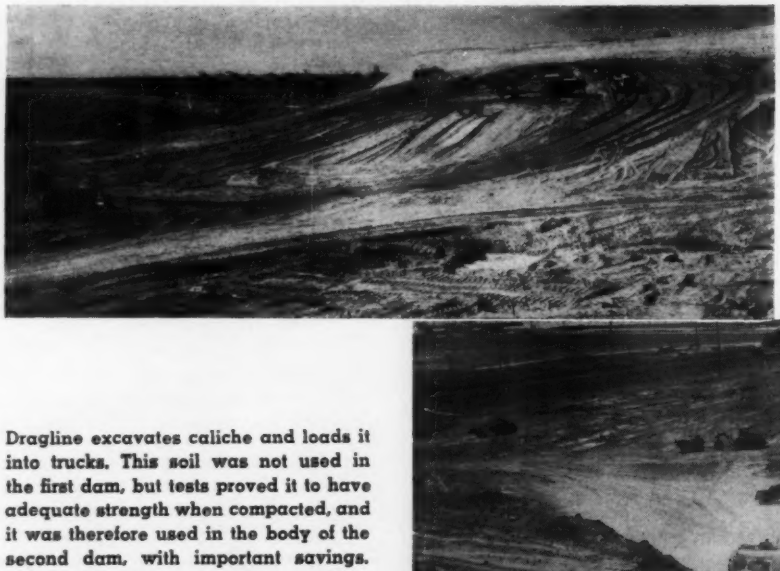
The Lake Pontchartrain Breakwater was designed by the owner, the Orleans Levee Board, and constructed by the Louisiana Paving Co. The construction of the Pass Christian Breakwater was carried out by T. L. James & Co., Inc.

EARTHEN RESERVOIRS
for fuel-oil storage

G. A. RETI, A.M. ASCE

Civil Engineer, Amuay Bay Refinery

Creole Petroleum Corporation, Venezuela



Sandy clay fill obtained from the backslopes of the cliff was used for the body of the dam. Reservoir capacity was considerably increased by use of borrow from cliff backslopes.

Dragline excavates caliche and loads it into trucks. This soil was not used in the first dam, but tests proved it to have adequate strength when compacted, and it was therefore used in the body of the second dam, with important savings. Tournapull and tractor scrapers haul silty clay fill to dam, which rises in the upper left corner.

Economy and speed of construction—factors important to all engineering projects—were influential in the construction of two large earthen reservoirs now storing fuel oil at the Amuay Bay, Venezuela, Refinery of the Creole Petroleum Corporation. These reservoirs, with a combined capacity of 12 million barrels (504 million gal) are used for the seasonal storage of fuel oil produced in the refinery.

The conventional method of storing refinery products is in steel tanks. The capacity of such a storage tank is normally between 100,000 and 200,000 barrels. For the storage of large quantities of oil by this method, costly tank farms are required covering extensive areas around refineries. In addition to valuable land, long piping connections are needed for such tank farms. Where the flexibility of storage provided by a tank farm is not essential, and where the character of the liquid does not require closed storage, the use of large earthen reservoirs has proved very economical.

Since fuel oil contains few volatile elements, it can be stored in open reservoirs without appreciable deterioration. To provide the storage capacity represented by the smaller of the two reservoirs at Amuay Bay, it would have been necessary to erect 24 steel tanks each with a capacity of 150,000 barrels. These tanks would have required an area of over 110 acres.

In the design of both the reservoirs at Amuay Bay, advantage was taken of the clifflike formation of the coast to the west of the refinery. There the low level of the beach extends inland for several hundred feet. Then the cliff rises suddenly and almost vertically to about El. 100. At the location where the reservoirs were built, the cliff curves inland in an uneven line thus creating small valley-like areas. The reservoirs were formed by building earth dams to close off two of these recessions in the cliff line.

The first reservoir was built between June and September 1955. The dam, 40 ft high and 1,140 ft long, closes off the west side of an open rectangle in the cliff line, thereby creating a large earthen reservoir (Fig. 1). The area thus en-

closed is approximately 600,000 sq ft (about 14 acres).

The cross-section of the dam is shown in Fig. 2. The upstream blanket consists of a highly plastic clay removed from within the reservoir area. Since this clay was removed from the borrow area in large lumps, it had to be broken up with sheepsfoot rollers and a Seaman Pulvimixer prior to compaction. To insure imperviousness, a homogenous blanket was essential.

For the body of this dam, a rolled sandy clay fill was used, also obtained from the backslopes of the cliff, inside the reservoir area. The sand drain, 3 ft thick, consists of medium beach sand trucked to the site. The purpose of this drain is to relieve the excess pore pressures set up by the weight of the dam, thereby accelerating the consolidation of the foundation. Obtaining the fill materials within the reservoir area significantly increased the storage capacity, which is 3.5 million barrels (147 million gal).

In view of the success of this first reservoir, and the need for a large volume of additional storage to meet expanded outlets, another reservoir was designed to store 2½ times as much oil. The second reservoir, built between June and September 1956, is located about half a mile to the south of the one built the previous year. Here a horseshoe-shaped dam 54 ft high and 2,100 ft long closes off a roughly triangular shaped recession in the cliff line. The area enclosed is almost 1 million sq ft; its storage capacity is 8½ million barrels (375 million gal).

Experience gained during the design, construction and operation of the first reservoir resulted in a modified cross section for the second dam (Fig. 3). The steep, 1: 1½, upper part of the first dam was found to have poor erosion resistance and was redesigned to a gentler slope, 1: 2, protected by a soil-cement layer. A berm, halfway up on the inside slope, improved drainage and provided easier access. A non-plastic, powdery silty granular soil, locally called caliche, is found in the area in a naturally cemented state. This soil was wasted during the construction of the first dam. More elaborate laboratory tests showed this soil had adequate strength when properly compacted. Therefore caliche was used in the body of the second dam, resulting in important savings.

As on the first dam, an upstream blanket of a highly plastic clay was used. However, to improve the erosion resistance of the upstream face, a soil-cement cover 4½ ft thick was placed over the clay blanket. The dam proper is a rolled fill utilizing a mixture of sandy clay and caliche. All fill material was obtained from the backslopes of the cliff, thereby increasing the reservoir storage volume.

Foundation conditions under both dams were relatively poor. Borings and test holes revealed the following subsoil condition under the first dam. A relatively firm surface layer of silty clay about 5 ft thick was underlain by a soft layer of bluish gray silty clay. Under this second layer, which was also about 5 ft thick, there was more clay—of medium stiff consistency and occasionally mixed with dense sand. The ground-water level was 6 ft below the surface.

At the second dam site, borings and test holes showed that a very soft surface layer of loose silty clay about 6 ft thick was underlain by more clay, which became firmer and stiffer with increasing depth.

Elastic methods of analysis showed that the foundation soils would be dangerously overstressed by the weight of the dam. The Swedish circle method of analysis indicated however that the foundation was relatively safe against a slip type of failure. The factors of safety obtained by analyzing the weakest sections were 1.45 and 1.6 for the first and second dams respectively. Predicted settlements in the first dam were about 2 ft. Measurements during the first year after construction confirmed this predicted rate of settlement. Based on experience with the first dam, the settlements in the second dam were predicted to be about 12 to 14 in. To date the second dam has settled 10 in. over the weakest part of the foundation.

Laboratory tests indicate a considerable gain in strength as the consolidation of the foundation soils progresses. Therefore the initial factors of safety against a slip type of failure should improve considerably with time. The clay-

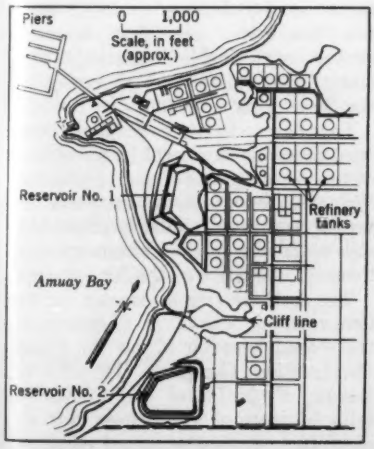


FIG. 1. Overall map of Amuay Refinery shows locations of earthen storage reservoirs in relation to the refinery, the steel storage tanks, Amuay Bay and the piers. "Cliff line" represents El. 90 approximately. Straight dam with sharp angles and curved cliff line bounds Reservoir No. 1 while a horseshoe-shaped dam against the cliff face was used for Reservoir No. 2.

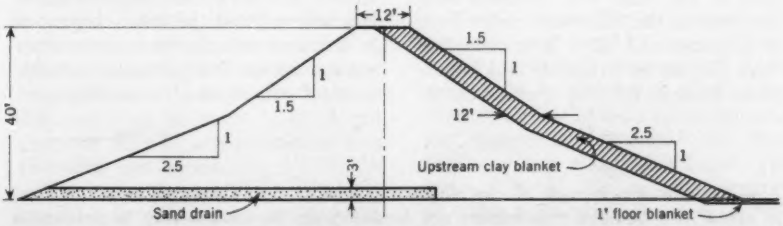


FIG. 2. Cross section of dam for Reservoir No. 1 shows impervious clay blanket on the upstream face and sand drain under the downstream slope.

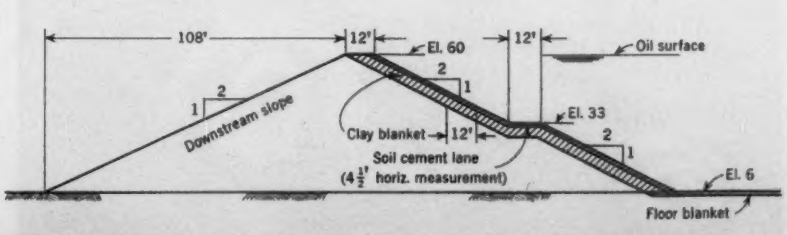


FIG. 3. For Reservoir No. 2, the impervious clay blanket of the dam's upstream face was protected by a 4½-ft layer of soil-cement. Halfway up this face, a berm improves drainage and provides better access.

Sandy silty clay fill for dam body was compacted with sheepsfoot rollers. Rubber-tired equipment can also be seen compacting the reservoir lining. At far right part of Amuay Bay can be seen.

blanket lining readily followed these large settlements; it is doubtful whether a concrete lining could have deflected so much without cracking.

One of the interesting points in the stability analysis was that no pore-water pressure due to seepage had to be considered as acting on the failure wedge. Theoretical considerations supported by experimental evidence showed that under a head corresponding to the reservoir depth, the fuel oil could not seep into a properly compacted clay sample. This head (25 psi) was insufficient to displace the water attached to the clay particles. The very low permeability of the clay blanket to oil penetration can be explained by the interaction of electrical forces between the clay particle and the water film attached to it.

The clay blanket lining on the inside faces of the dams was extended onto the floors of the reservoirs in the form of a compacted clay layer one foot thick. To assure a flexible and impervious blanket, the clay linings on the floors and on the dams were placed at a moisture content a few percent above optimum. Under such conditions laboratory tests indicated permeabilities in the order of 10^{-9} cm per sec for the clay used. Small test holes dug in the dam, floor and cliff walls after the first season of use showed that the oil had penetrated into the compacted clay no more than about 6 in. In the unlined backslope of natural ground, some soft spots showed penetrations of a few feet.

In each reservoir oil is admitted and withdrawn through two steel pipes of 24-in. diameter. These pass through the dam and discharge into a concrete box designed to prevent erosion of the floor and break any vortices that may form under suction.

It is difficult to assign accurate values to the losses of fuel oil in these reservoirs. In addition to the fuel-oil penetration into the soil as described above, it is believed that the steady high wind in this area contributes to some evaporation losses. No accurate measurement of such losses is at present available. The volume loss of oil between that admitted to the reservoirs and that removed after storage is of the order of one percent of the total volume. The significance of this figure is questionable since the gaging accuracy of the measuring equipment is roughly of the same order of magnitude.

One of the most attractive features of open earthen reservoirs is their relative economy as compared with steel tanks. This favorable cost aspect results chiefly from the use of a select clay blanket to line the inside of the reservoirs rather than an expensive concrete lining. The cost of storing oil in conventional steel tanks is over $2.00 per barrel. The cost of storing fuel oil in the earth reservoirs here described is approximately $0.30 per barrel, which includes the cost of piping and pumping facilities.

Another important factor that led to the decision to build these large earthen reservoirs was the speed with which they can be constructed. Each reservoir was completed in about three months. It is estimated that the construction of steel tanks with a volume equivalent to that of one reservoir would have required more than two years. The storage reservoirs were built of earth available at the site. The materials for steel tanks would have had to be imported from the United States or Europe, with consequent long delays in delivery. By having storage facilities in operation at an early date, it was possible to store fuel oil to meet a high demand for the following season. This saving in time represented a very important factor in the decision to build these two reservoirs. The first reservoir proved very valuable in meeting the increased demand for fuel oil caused by the Suez crisis of 1956.

Experience to date indicates that open-reservoir storage of large volumes of fuel oil is successful and economical. Favorable topographical features in the terrain and the availability of suitable soils made this method of storage particularly attractive in the Amuay area.

The earth-moving contractor for the first reservoir was C. A. Caminos; on the second reservoir it was the Foster Construction Company. Dr. T. W. Lambe, F. ASCE, of the Massachusetts Institute of Technology, was the consultant on the design and construction of these reservoirs. The Amuay Refinery Civil Engineering Group supervised construction. Mr. R. H. Shakelton was in charge of the supervision of the construction of the first reservoir, and Mr. J. R. Fuller, A.M. ASCE, of the second. The author was actively engaged in the soils control work throughout the construction of both reservoirs.

After the dam was completed, the clay lining was extended onto the reservoir floor. In center two Seaman Pulvimixers are breaking up the plastic clay to produce a homogenous, impervious lining. In the distance, by the dam, two rubber-tired rollers are compacting this clay. In the foreground two graders and a dozer are shaping the foot of the cliff. Black line on reservoir floor at far right consists of twin 24-in. inlet and outlet pipes. At upper left a tanker is loading at the pier.

Containment of fragments from a runaway reactor

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Stanford Research Institute, Menlo Park, Calif.

In the event of a runaway reactor, a control rod could be a very impressive projectile. If the energy released in the reactor excursion should succeed in expelling a rod or similar missile, the outer vapor container of the reactor would be threatened. Adequate protection from such a threat depends on the vulnerability of the steel shell constituting the vapor container. The study here reported was made to evaluate the vulnerability of steel plate simulating the material of the normal Horton sphere. Since the primary concern was with relatively massive missiles striking mild steel at a low velocity, the available data on the effect of high-velocity missiles on armor plate were not directly applicable.

Missiles in a wide range of sizes were employed to determine the requirements for penetrating steel plate. Several methods of missile propulsion were found necessary. Steel cylinders weighing up to 33 lb were given velocities up to 1,250 fps with 90-mm breechless rifle barrel acting as a recoilless rifle. The projectile energy reached nearly ½ million ft-lb. Small-scale projectiles were fired at scaled-down thicknesses of target with a sawed-off, smoothbore, 45-caliber Winchester rifle, and with a type of crossbow, specially constructed from an automobile leaf spring and aircraft cable. The rifle delivered up to 1,000 ft-lb of energy to a rod; the bow was limited to about 250 ft-lb. A smaller hunting crossbow was used for energies below 25 ft-lb.

Projectiles for small-scale penetration experiments varied in length, diameter, density, and strength. Steel rods ranged in length from 5½ in. to 12 in. and in diameter from 3/16 in. to ½ in. A rod diameter of 7/16 in. made a good fit in a 45-caliber gun barrel.

The course of a projectile after leaving the propulsion device was through an aperture in the end of a long steel box. Before reaching the target it passed through a spaced pair of aluminum foil sandwiches to give timing pulses. After penetrating the target it was arrested in sand.

Targets of hot-rolled mild steel were clamped between two steel frames which provided rigid boundaries for the target area of the plates. The assembly of frames and target was mounted tightly against a braced steel plate one inch thick. Exit windows in the rear frame and supporting plate permitted the projectile to escape after penetration.

Kinetic energy per unit diameter of projectile was found to be a primary factor governing the thickness of target that could be penetrated. Shots were fired at targets of each thickness until the penetration threshold for that thickness was closely bracketed. The range between the minimum energy at which penetration occurred and the maximum energy at which penetration did not occur (with tool-steel projectiles alone) is indicated by the height of each rectangle in Fig. 1. The width of a rectangle represents the variation in thickness of targets. An empirical expression was found to relate rod kinetic energy, E, and diameter, d, with plate thickness, T, and ultimate tensile strength, S. This expression is:

$$\frac{E}{d} = \frac{S}{46{,}500}\,(16{,}000\ T^n + 1{,}500\ T)$$

The dashed curve in Fig. 1 is a plot of this expression for the average tensile strength, that is, S=46,500 psi.

Plates stronger than the average required proportionately higher energy for penetration. For example, from Table I, plates 0.190 in. thick, having

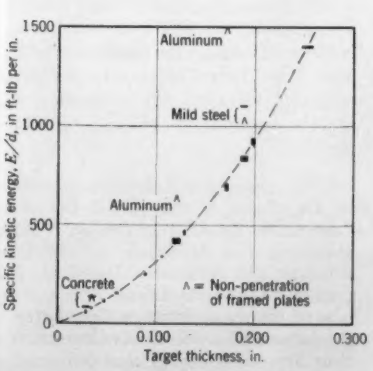


FIG. 1. Penetration of rigidly framed mild-steel plates 4 in. square by tool-steel rods and other materials is shown by plotting specific kinetic energy per unit diameter of projectile against target thickness. Height of rectangles indicates range between minimum energy at which penetration occurred and maximum energy at which penetration did not occur (with tool-steel projectiles alone). Specific kinetic energies of projectiles made of other materials are also indicated.

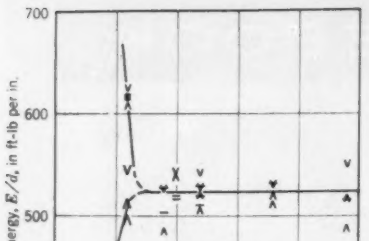


FIG. 2. Penetration requirements for rigidly framed and freely hanging targets are compared. Kinetic energy of projectile is plotted against size of target. Plate thickness is 0.120 ± 0.003 in. and projectile velocity, 150 to 300 ft per sec.

a tensile strength 48 percent above the average, required 42 to 45 percent penetration energy over that consistent with other data. Similarly, ¼-in. plates with tensile strengths 10 to 20 percent above the average had a threshold penetration energy of 16 percent higher. Thus it appears that energy is directly proportional to strength.

Additional modifications in penetration energy requirements occurred when a projectile became deformed on impact, when target boundaries were changed, when the impact was oblique, and when a projectile had a pointed end.

The principal results were obtained with tool steel rods that were deformed only slightly during the penetration process. The diameter of the rod impact face was always at least 1½ times the thickness of the plate for these tests. However, when an end of a rod was turned down to reduce the effective striking diameter, appreciable rod deformation was obtained during impact. Deformation also occurred when the rod was of weaker material, such as mild steel or aluminum. Both swelling and buckling were observed.

If penetration was achieved at all by a projectile that became deformed, the required energy per unit diameter was substantially greater than that needed by stronger rods. Values of energy are indicated in Fig. 1 for which no penetration at all (inverted V) and a small break or crack (bar) were obtained with rods of aluminum, mild steel, and concrete.

Penetration energy is influenced by target boundaries near the point of impact. If the boundary is rigid, as on a framed target, the required energy is reduced—lower left branch of the curve in Fig. 2. If the boundary is a free edge, as on a hanging target, the required energy is increased, as seen in the upper left branch of this curve. If either type of boundary is far enough from the point of impact, no effect is produced. That is, below a certain critical distance from a rigid boundary a projectile can penetrate more easily because of the rigidity. Below the same critical distance from a free boundary, it is more difficult for the projectile to penetrate. Implications for the reactor designer are that small hanging plates are ideal as energy absorbers, and that especially vulnerable points on a reactor shell are near rigid supporting members.

Penetration is slightly more difficult to achieve if the angle of impact is oblique. Threshold energies are about 10 to 15 percent above that for normal impact. Up to 15 degrees from normal the amount of increase is nearly constant.

Contrary to intuition, a flat-ended projectile needs less energy than a conically pointed one to completely penetrate a plate. However, when the cone angle is sharp enough (in the neighborhood of 45 deg or less), relatively low kinetic energy can result in small perforations through the target, even though the projectile is repelled.

To compare dynamic results with static tests, measurements were made of the work required to force short cylindrical rods through framed target plates. This static work was very nearly one-half the kinetic energy of penetration for each thickness of plate.

Results of large-scale penetration experiments were in agreement with the small-scale results. A 22½-lb mild-steel projectile with a hardened tool-steel nose penetrated the 1-in. thickness of a mild-steel target with a velocity below 400 fps. The kinetic energy per unit diameter (21,000 ft-lb per in.) was near the value predicted by the thin-plate data. The terminal appearance of target plates was similar, and plugs punched from the plates had similar shapes.

Quality of steel is very important in providing defense against penetration. Three different lots of 1-in. plates, all hot-rolled mild steel not differing significantly in carbon content and tensile strength, were employed as targets in the large-scale tests. The resistance to penetration of one lot was consistent with other data. Plates from the other two were breached by projectiles having less than half the kinetic energy per unit diameter required by the first. Brittle fracture with practically no outer plate deformation characterizes the weaker plate and the plug sheared from it, as opposed to ductile flow and appreciable plastic deformation evident in the stronger. Metallographic examination of the steels showed carbide striations among unusually large grains in the weaker material. This structure can be attributed to the type of heat treatment in the manufacture of the plate.

In summary, then, it has been found that a number of factors have a significant influence on the penetration of steel plate by rodlike projectiles. Kinetic energy per unit diameter is the important factor linking velocity, mass and size. Resistance to penetration by ordinary mild steel is proportional to tensile strength. Soft projectiles need more energy than hard ones to penetrate a target. Rigid target supports enhance penetration; free edges retard it. Oblique impact and points on projectiles make penetration more difficult. The granular structure of steel has important effects on its resistance to impact. The design of missile shields of optimum strength for a reactor will require recognition of each of these factors.

TABLE I. Comparison of tensile strength and penetration energy

Plate Thickness in.	Tensile Strength 10^3 lb per in.^{2}	Percentage Increase in Strength	Penetration Energy ft-lb per in.		Percentage Increase in Energy
			Predicted	Actual	
0.030-0.120*	45-48	0 (reference)	....	....	....
0.190	69	48	860	1,220-1,250	42-45
0.250	51-56	10-20	1,375	1,600	16

* Reference group.

(This paper was originally presented by Dr. Zabel at the ASCE Cleveland Convention before a session on Nuclear Structures and Materials, of the Construction and Structural Divisions. The presiding officer was Abbott Frank, chairman of the Administrative Committee of the latter Division's Committee on Nuclear Structures and Materials.)

Cable-reinforced prestressed concrete for a reactor vessel

Prestressed concrete is being used to withstand high pressures in the containment vessels for two natural-uranium reactors under construction in Marcoule, France. These pressure vessels act also as biological shields. The two 32-emw-net graphite-modulated, gas-cooled reactors have a number of unusual features but the cable reinforcing of the concrete pressure vessels is of special interest to civil engineers.

Each pressure vessel is in the form of a horizontal cylinder closed at both ends by concave hemispheres (Fig. 1). The inside diameter of the cylinder is 14 m (46 ft) and the inside length, 18 m (59 ft). The overall length, including domes, is 34 m (112 ft).

The vessel was designed for an operating pressure of 15 kg per cm² (213 psig) and was hydraulically tested at twice that pressure. The walls have a uniform thickness of 3 m (10 ft). It is supported by a longitudinal cradle. Vessel and cradle together weigh about 26,000 tons, of which 1,400 tons are steel. A "flexible skin" of gas-tight thin steel plate is used as a lining to provide shielding because of the porosity of the concrete.

Prestressing must be such as to avoid residual stresses, which are likely to give rise to fissures in the concrete. Therefore three systems of prestressing cables are used—circular, longitudinal, and transverse. See Fig. 2.

For the cylindrical system of prestressing, 57 cables run around the pressure vessel along its 34-m length, covering about 250 deg of its outside circumference. As they approach the under side of the cylinder they become straight and pass through the supporting cradle to anchorages beneath it.

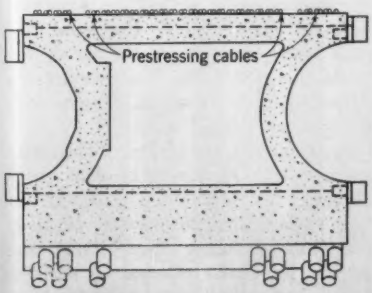


FIG. 1. Pressure vessel is in the form of a horizontal cylinder closed at both ends by concave hemispheres.

The longitudinal component of the internal pressures is countered by 46 straight horizontal cables which pass through the walls of the pressure cylinder for its full length. They take their bearing on its terminal faces, ending in a circle of anchorages.

To complete the prestressing, transverse straight cables run horizontally to compress the upper parts of the two horizontal girders at the base of the pressure cylinder (Fig. 2). The concave configuration of the ends of the cylinder provides resistance to the other components of the internal pressures.

Cables are made up of wires with a a diameter of 5 mm (0.2 in.), a breaking strength of 140 kg per mm² (about 200,000 psi), and an elongation at rupture of 3 percent.

Cables are prestressed by jacks arranged between the concrete wall and one of the terminal anchorages. A tensile stress of about 1,200 tons is applied to each cable, which results in an equivalent compressive stress in the concrete.

(The above information is taken from Part A of a group of eight papers contributed by the Nuclear Engineering Division of the American Society of Mechanical Engineers, presented at the Fifth Nuclear Congress in Cleveland, Ohio, April 5-10, 1959, and coordinated by the Engineers Joint Council. Part A, dealing with the concrete envelope and the reactor core, was presented by G. Deleuze of the Société des Forges et Ateliers du Creusot, and M. Tourasse, of the Compagnie Industrielle des Travaux. Messrs. Coyne and Bellier acted as consulting engineers on the prestressed concrete techniques described.)

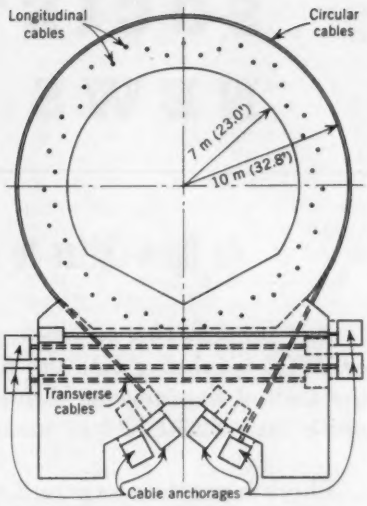


FIG. 2. Cross section through cylinder of pressure vessel shows three systems of cable reinforcing—cylindrical, longitudinal, and transverse.

THE READERS WRITE

Asphalt membrane for subgrade seal

TO THE EDITOR: I am quite interested in J. J. Galvan's analysis of "Water in the Subgrade—a Pavement Problem" (CIVIL ENGINEERING, May 1959, vol. p. 342).

The idea of an asphalt membrane is excellently presented as a logical aid to good drainage and waterproofed subgrades. However, I must take exception to Engineer Galvan's recommendation of MC-0 or MC-1 asphalt for this application. This is suitable as a prime material where some penetration is desired. It will do some plugging of capillary tubes but not enough to be of real value as a membrane. An asphalt cement having a normal penetration of 50 to 60 with a ring and ball softening point between 175 to 200 deg F is desirable for a membrane. The sprayed application should be at a rate of from 1.5 to 2.0 gal of asphalt cement per square yard.

The State Highway Department of Texas used an asphalt similar to this for enclosing heavy clay soils on 2 miles (about 380,000 cu yd) of embankment on the Gulf Freeway. This membrane enveloped the soil, which was placed at its best density and strength. A program of periodic testing, since its construction in 1947, has convinced highway engineers in Texas that the asphalt has not migrated or deteriorated and that there has been no appreciable change in the moisture content or strength of the soil enclosed in the envelope.

JAMES C. JOHNSON, M. ASCE
Staff Engineer
The Asphalt Institute
College Park, Maryland

SOCIETY NEWS

An Open Letter to All Members of ASCE

As I prepare this message, the national and local leadership of ASCE is moving into the final—and the hardest—phase of the United Engineering Center campaign. We must still raise more than $250,000 to meet our assigned $800,000 quota.

There is much to be proud of in our progress to date. Twenty percent of our membership has responded with pledges totaling almost $550,000. To these members, and especially to the loyal workers who are actually conducting the campaign, the Society is greatly indebted. I acknowledge their support and their loyalty with pride and deep gratitude.

But what about the finish of the campaign? We are not through until the entire $800,000 is pledged.

All of us—particularly those who are responsible for the work of the Society—are becoming tired of the fund-raising effort. We deplore the need for putting pressure both on workers and members. We will hail the day when we reach our goal so that we can return our efforts to those many important activities that are the true province of ASCE.

We have set our sights for October 1 as the finish of the campaign. Ground will be broken for the new building about the middle of October. It will be possible for us to accomplish our goal only with the full cooperation of all of our 43,000 members.

To the end that our revered Society may hold its place of leadership in the engineering profession, I ask your help. Not only do we need your pledge, but we also need your active assistance to the officers and committees of your Section who are carrying on the drive locally. And your word-of-mouth support of the project will lead many of your brother engineers to join with the builders of the United Engineering Center.

Our Society needs your help. LET'S GET THE JOB DONE! THERE IS NO SUBSTITUTE FOR VICTORY!

Sincerely yours,

Francis P. Friel

UEC HONOR ROLL

The UEC Honor Roll now boasts twenty Local Sections—slightly over 25 percent of our total number. Newcomers to the list are the Puerto Rico and Wisconsin Sections. The Sections are listed in the order of meeting their goals, and the figures indicate percentages attained on July 3.

Kentucky (109)
Lehigh Valley (131)
Nashville (103)
Cincinnati (141)
Columbia (127)
Philadelphia (125)
Hawaii (119)
Rochester (123)
Ithaca (114)
Southern Idaho (144)
Indiana (130)
Delaware (104)
Kansas City (109)
Central Pennsylvania (104)
Arizona (108)
West Virginia (117)
Central Ohio (102)
Tri-City (100)
Puerto Rico (106)
Wisconsin (101)

Once again congratulations to District 4, which continues in solitary eminence—the only District that has exceeded its quota and the only District whose Sections have all exceeded their quotas.

AIChE Goes Over Top In Drive for Funds

The big news in the overall picture of member giving is that the American Institute of Chemical Engineers has gone over the top in the drive for funds—the first of the five Founder Societies to meet its quota. Sincere congratulations, AIChE!

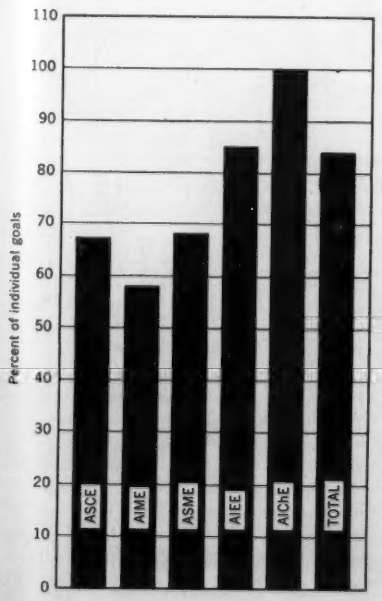
As of July 10, the Electrical Engineers are next with 85 percent of their quota pledged; the Mechanical Engineers in third place with 68 percent pledged; and ASCE in fourth place with 67 percent of its quota collected or pledged.

Member giving up to now stands at $2,517,905, within 16 percent of the $3,000,000 goal the Founder Societies have set themselves.

Campaign in ASCE Sections

Local Section	Quota %	Local Section	Quota %
Over the Top			
South Idaho	144	Kansas City	109
Cincinnati	141	Kentucky	109
Lehigh Valley	131	Arizona	108
Indiana	130	Puerto Rico	106
Columbia	127	Central Pa.	104
Philadelphia	125	Delaware	104
Rochester	123	Nashville	103
Hawaii	119	Central Ohio	102
West Virginia	117	Wisconsin	101
Ithaca	114	Tri-City	100
Going Strong			
Rhode Island	90	Metropolitan	79
Iowa	87	Illinois	77
Connecticut	85	Maine	76
Tacoma	83	Tenn. Valley	75
Past the Mid Point			
Central Illinois	73	Seattle	58
San Francisco	73	Kansas	57
Syracuse	73	Duluth	53
Texas	73	Mid-South	53
Georgia	72	Akron	51
Nebraska	71	Sacramento	51
Spokane	66	Maryland	50
Pittsburgh	63	North Carolina	50
Buffalo	62	St. Louis	50
Dayton	62	Toledo	50
Massachusetts	59		
Getting on Target			
Mohawk-Hudson	48	Alaska	38
San Diego	48	New Mexico	37
South Carolina	47	Venezuelan	37
Intermountain	46	Northwestern	35
Cleveland	44	Nat'l Capital	34
Montana	44	Panama	33
Los Angeles	42	Colorado	32
Mid-Missouri	42	New Hampshire	32
Oklahoma	39	Alabama	30
Oregon	39	Wyoming	28
Virginia	39	South Dakota	26
Slow Starting			
Louisiana	22	Florida	13
Michigan	19	Brazil	11
Miami	15	Rep. Colombia	10
Mexico	14		

Fig. 1. Member giving for United Engineering Center as of July 10.



ASCE Annual Convention to Be Held in Washington, D. C.

This year's Annual Convention—to be held in the Statler-Hilton, Washington, D. C., October 19-23—will offer the lure of one of the nation's most exciting cities for a background as well as the usual top technical and social program traditionally associated with Annual Conventions. The program, keynoted to an international theme, will be featured in the September issue.

Many Field Trips on the Agenda

In addition to the time-honored Washington sights that seem to become more interesting and meaningful with each viewing, engineer visitors this fall will find the city and its surrounding area in the throes of much exciting new construction.

Plans have been completed for an all-day trip that will include inspection of the George Washington Memorial Parkway at Chain Bridge on the Potomac; a building underway for the Central Intelligence Agency near McLean, Va.; luncheon at Herndon, Va.; inspection of the new Washington International Airport near Chantilly, Va.; a glimpse of the interchange between the circumferential and axial highway at Annandale, Va.; and the inspection of Jones Point Bridge over the Potomac near Alexandria.

A trip will be made to the world's third largest secondary sewage treatment plant at Blue Plains in the Washington environs. The new Senate Office Building, the additional House Office Building, and the construction work on the east facade of the Capitol may become the nucleus of another trip. A trip may also be arranged through the new State Department Building, which is scheduled for completion early in 1962. Foundation problems in the raw will be seen in the excavation for the additional House Office Building. They include a straightened Tiber Creek Sewer, an important link in the city's storm drainage system, in a concrete box, with the box becoming a part of the building.

The ladies have not been forgotten in the planning and will have their own tour of the sights that make Washington the tourists' favorite. They will visit Mount Vernon, the home and burial place of George Washington, and the Woodlawn Plantation and mansion. After luncheon at Pohick Church, where Goerge Washington was vestryman, the group will visit Gunston Hall, the colonial home and gardens of George Mason, author of the Virginia Declaration of Rights.

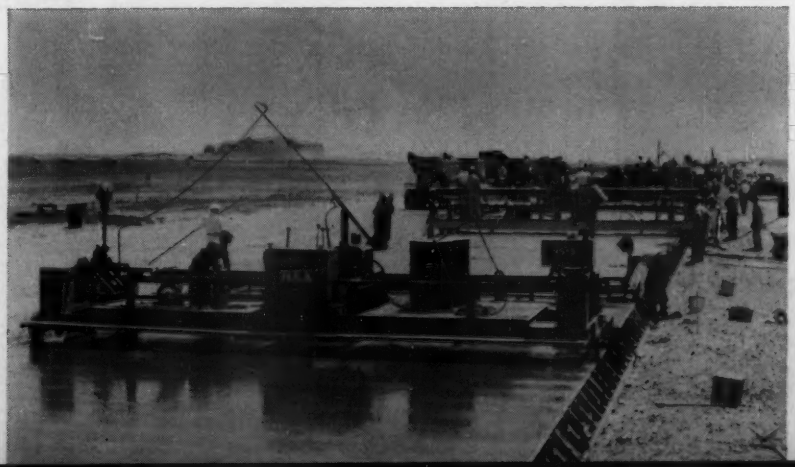
In addition to the trips planned by the Convention Committee, the commercial sightseeing organization at the Statler-Hilton has a number of scheduled trips and will arrange special tours for large or small groups upon request.

Pan American Smoker

One of the anticipated features of the social program will be the smoker, to be held in the Pan American Union Building. Here, too, an international atmosphere will be dominant, as the program is being sponsored in part by civil engineers from South America. The building is well known for its beautiful glassed-in patio full of tropical vegetation and exotic birds. So that the ladies won't miss these picturesque surroundings and the special music that is being arranged, they will have their own "puffer" there the same night.

Eugene F. Baldi is general Convention chairman, and Mrs. Baldi will head the ladies' program. Eugene W. Weber is chairman of the technical program.

Airport construction is on the tour agenda for the Washington Convention. Shown here is a train of equipment paving a 25-ft width of the 11,500-ft-long runway at Dulles Airport (formerly Washington International) near Chantilly, Va., 27 miles southwest of Washington. This runway has a 150-ft width of 15-in.-thick concrete—18 in. at the ends—with 25-ft-wide asphalt strips at each side. C. J. Langenfelder & Son, Inc., is contractor, and Ammann & Whitney are the engineers for the Federal Aviation Agency on construction.



Civil Engineering Salaries Rise in 1959

ASCE Committee on Salaries Reports

Oscar S. Bray, *Chairman* William J. Carroll, Jr., *Vice-Chairman*

Warren W. Parks Melvin R. Williams Randle B. Alexander

This is a digest of the fifth in a series of ASCE biennial salary surveys. Civil engineering pay scales reported here show a continuation of the general uptrend noted in 1957. Professional grade rates have increased 6.2 percent—preprofessional, 2.6 percent—in the two-year survey period.

Questionnaires similar to those used for the 1957 survey were mailed in January 1959. Returns received from 331 organizations, representing 64,080 employees, form the basis for this report. Distribution of respondents by professional activity category is as follows:

	No. of Organizations	No. of Engineering Employees
Consulting Firms	90	6,401
Construction Firms	30	2,561
Railroads, Utilities & Industries	30	4,630
Total private organizations	150	13,592
State Highway Departments	36	42,393
Municipalities & Counties	54	6,422
Total public agencies	90	48,815
Educational Institutions	91 91	1,673 1,673
Grand Total	331	64,080

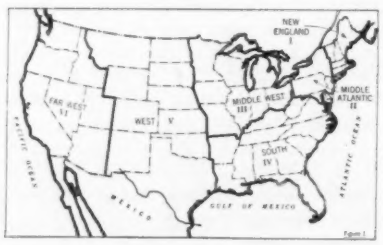
With few exceptions, the U.S. Civil Service Commission salary rates are standard throughout the country. Therefore no replies were solicited from federal agencies for purposes of this report. Current federal annual pay scales are plotted in Fig. 10.

Although respondents to the 1959 survey do not entirely duplicate those represented in the 1957 survey, the overlap is sufficient to warrant comparison. Salaries are reported according to entrance and maximum rates for all twelve ASCE grades in each category surveyed. In the full report, to be published in October, rates are given for the median, middle 50 percent, and total range in each grade. The median is that figure having 50 percent of the replies lower and 50 percent higher. The middle 50 percent is determined by eliminating the upper 25 percent and lower 25 percent. Total range represents the lowest and highest figures reported in each grade. No attempt is made to establish medians by number of employees.

Salary Charts

Charts for each category (Figs. 4 through 9) present graphical studies of salary trends. The curve near the top of each chart shows the pattern of grade rate changes for each category. No general trends are indicated at various levels of the grade series for the six categories surveyed. This is true of grade levels in preprofessional as well as professional classifications.

The charts also show curves for entrance and maximum medians in all grades of each category. Values for the 1957 entrance medians are plotted for comparative purposes. It will be noted



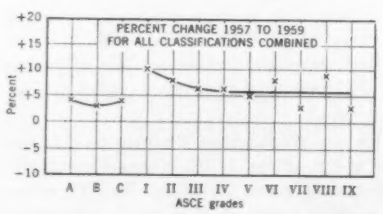


Fig. 2

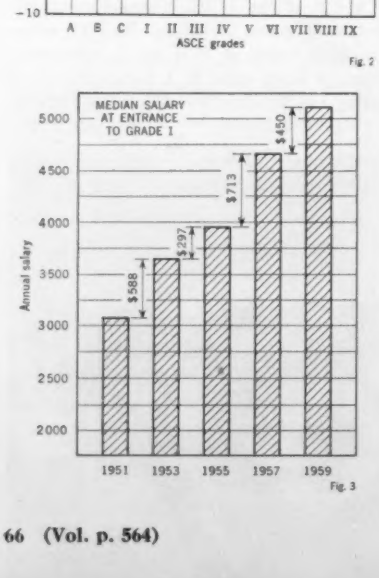


Fig. 3

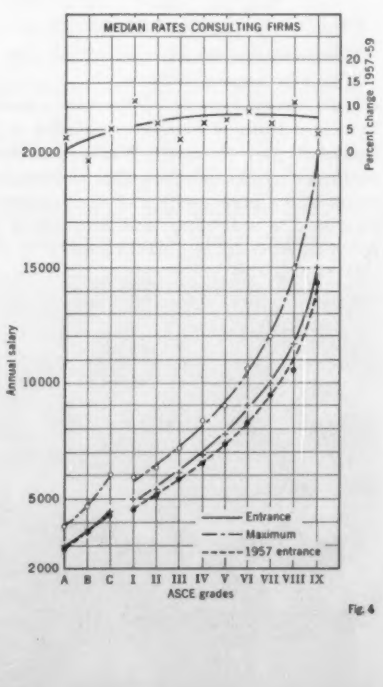


Fig. 4

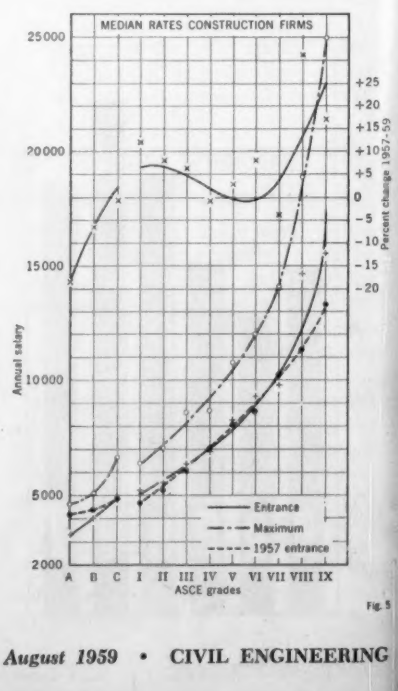


Fig. 5

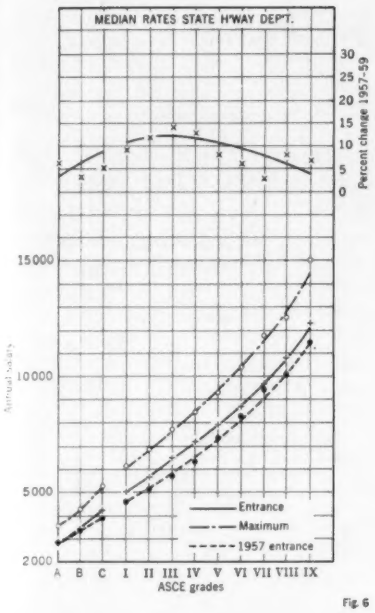


Fig. 6

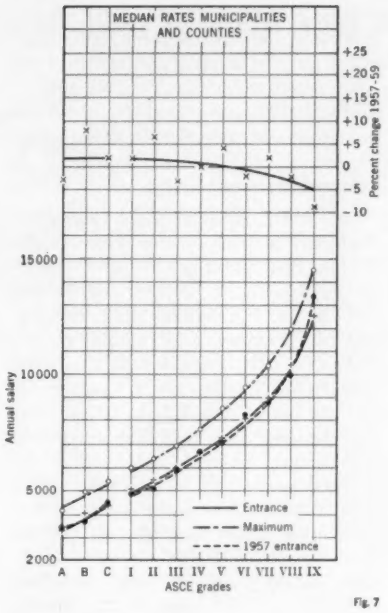


Fig. 7

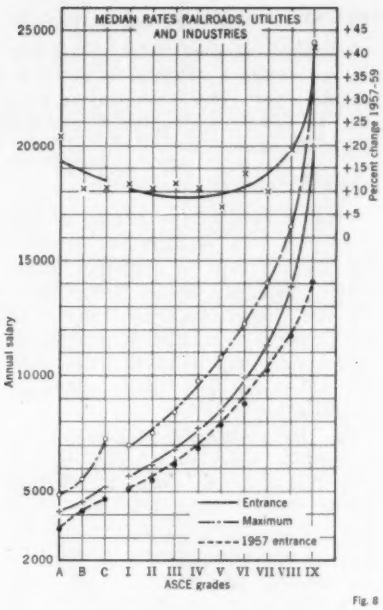


Fig. 8

hat the 1959 median curves drop slightly elow the 1957 values at certain grade evels for consulting firms, construction irms, and municipalities and counties Figs. 4, 5 and 7). This would appear to e due to normal scattering of data from he two surveys.

A rather significant drop (8.8 percent) s seen in the preprofessional rates or contractors. A 1.0 percent drop in the ombined professional grades for municiualities and counties may have little significance. Fewer samples were available for the 1957 analysis of this category.

The greatest increase in combined preprofessional rates is 14.1 percent for railroads, utilities and industries (Fig. 8). Greatest increase in combined professional grades is 11.1 percent for educators (Fig. 9).

The following tabulation shows overall percentage changes (1957-1959) in professional and preprofessional classifications for each category surveyed. These figures are based on averages of entrance medians for combined grades in each category.

	Preprofessional	Professional
Consulting Firms	+2.2	+6.9
Construction Firms	−8.8	+10.2
State Highway Departments	+4.6	+8.3
Municipalities & Counties	+2.2	−1.0
Railroads, Utilities & Industries	+14.1	+4.3
Educational Institutions	—	+11.1
All categories combined	+2.6	+6.2

Increases in federal salary rates (Fig. 10) range from 10 to 22 percent. The greatest increase is in the entrance rate for Federal Grade 5 (ASCE Grade I). The overall increase (all grades combined) is 13 percent. This figure is comparable to a 5.7 percent increase for combined entrance grades (professional and preprofessional) for all categories surveyed.

Educational Institutions

Increases for educators range from 6 percent for instructors to 14 percent for professors. Rates for assistant and associate professors show an 11 percent increase—heads of departments, 12 percent. For comparative purposes, salaries paid by educational institutions are adjusted to an eleven-month basis (see Fig. 9). A similar adjustment was made in the 1957 report. No attempt has been made to evaluate educators' supplementary income.

Starting Salaries for Graduates

National entrance rates to Grade I, 1951 through 1959, are shown in Fig. 3. An increase of $225 per year for the 1957-1959 survey period is within reasonable range of the $266 yearly average for the three preceding biennial surveys. The 1957-1959 increase in Grade I is 10 percent. Comparable increases for 1955-1957 and 1953-1955 were 18 and 8 percent, respectively.

The average increase in the 1959 survey for professional grades II through IX is 5.9 percent. The range here is from 3 percent for Grades VII and IX to 9 percent for Grade VIII (see Fig. 2). Proportionately greater increases in compensation for Grade I reflect the continued demand for engineers just out of college. The comparable federal grade (GS-5) increased 22 percent in the same period (see Fig. 10).

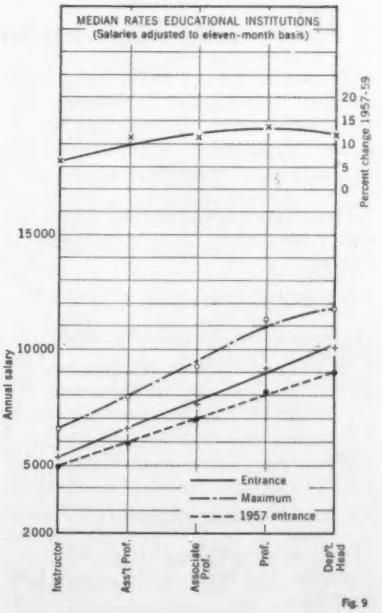
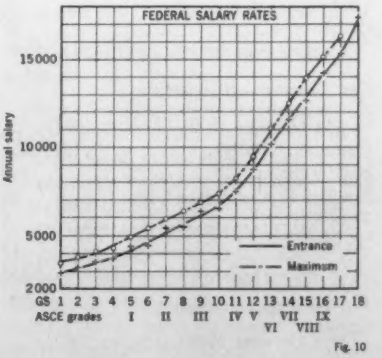


Fig. 9


FEDERAL SALARY RATES
Annual salary
Entrance
Maximum
GS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
ASCE grades I II III IV V VI VII VIII IX
Fig. 10

Regional Relationships

A regional breakdown for each grade of each category surveyed is given in the full report. The accompanying map (Fig. 1) shows the geographical makeup of the six regions.

Fringe Benefits

Tangible benefits are gaining greater acceptance with organizations employing large numbers of engineers. These factors, commonly termed "fringe benefits" or "perquisites," are subject to specific dollar evaluation. Added to the payroll rate, they produce a sum that can be designated "total equivalent compensation."

For the purposes of this report, no attempt is made to evaluate perquisites. However, respondents to the 1959 ASCE Survey have provided ample data to warrant a separate study. An analysis of such tangibles as bonuses, profit-sharing plans, annual leave, sick leave, retirement, health and life insurance programs will shed light on the importance fringe benefits have assumed in the overall pay structure of many organizations. In the 1957 survey, fringe benefits amounted to about 15 percent of the annual salaries reported.

Acknowledgement

The ASCE biennial salary survey is conducted in conformance with Society Bylaws that commission the Committee on Salaries to "collect, codify, and prepare for distribution such data as may be calculated to be of value to employers of civil engineers and to civil engineering employees in connection with the proper classification of engineering positions and equitable compensation for such services."

The Committee is grateful to all those who supplied the basic data that made this report possible. Heavy demand for copies of past surveys is indicative of the value of these periodical appraisals of civil engineering salaries.

Tellers Canvass Ballot for 1960 Officers

New York, N. Y.
June 30, 1959

To the Secretary
American Society of Civil Engineers:

The Tellers appointed to count the Ballot for Official Nominees report as follows:

For Vice-President—Zone I

(Term October 1959—October 1961)

Charles B. Molineaux	1,062
Scattering	301
*Ineligible Candidate	46
Void	2
Blank	24
Total	1,435

For Vice-President—Zone IV

(Term October 1959—October 1961)

Lawrence A. Elsener	1,301
Scattering	341
*Ineligible Candidate	73
Void	3
Blank	39
Total	1,757

For Director—District 1

(Term October 1959—October 1962)

Elmer K. Timby	961
Scattering	110
*Ineligible Candidate	46
Void	1
Blank	15
Total	1,133

For Director—District 4

(Term October 1959—October 1962)

Samuel S. Baxter	325
Unavailable Candidate	†49
Scattering	53
*Ineligible Candidate	41
Void	0
Blank	0
Total	468

For Director—District 8

(Term October 1959—October 1962)

Thomas M. Niles	305
Walter D. Linzing	48
Scattering	28
*Ineligible Candidate	60
Void	0
Blank	1
Total	442

For Director—District 11

(Term October 1959—October 1962)

Trent R. Dames	814
Scattering	92
*Ineligible Candidate	86
Void	3
Blank	19
Total	1,014

For Director—District 14

(Term October 1959—October 1962)

Woodrow W. Baker	239
Scattering	32
*Ineligible Candidate	19
Void	0
Blank	1
Total	291

For Director—District 15

(Term October 1959—October 1962)

Bernhard Dornblatt	332
Scattering	56
*Ineligible Candidate	29
Void	0
Blank	11
Total	428

Total number of ballots counted	6,968
Ballot envelopes without signature	6
Dues arrears	10

Respectfully submitted,
Robert C. Johnston
Chairman
Joseph N. Rizzi, Jr.
Vice-Chairman
John C. Rutigliano
James B. Sullivan
Allan H. Wern
Tellers

*These votes were cast for incumbent officers who are presently ineligible for reelection in accordance with Section 9, Article VI, of the Constitution.

†Candidate unwilling to serve.

ASCE Membership as of July 9, 1959

Fellows	10,636
Members	15,305
Associate Members	16,989
Affiliates	89
Honorary Members	47
Total	43,066
(July 9, 1958	41,313)

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

City	Current	Previous
Atlanta	1.13	1.22
Baltimore	1.12	1.11
Boston	1.18	1.15
Chicago	1.36	1.30
Denver	1.21	1.20
Houston	1.26	1.12
Kansas City	1.11	1.14
Los Angeles	1.21	1.21
Miami	1.57	1.57
New Orleans	1.03	1.21
New York	1.25	1.21
Pittsburgh	0.95	1.05
Portland (Ore.)	1.16	1.11
San Francisco	1.24	1.19
Seattle	1.06	1.06

Highway Departments

Region	Current	Previous
I, New England	0.92	0.89
II, Mid. Atlantic	1.13	1.17
III, Mid. West	1.16	1.25
IV, South	1.08	1.10
V, West	1.02	1.02
VI, Far West	1.11	1.15

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current salary total for ASCE Grades I, II and III by an arbitrary base. The base is $15,930. This is the total of salaries paid in 1956 for the equivalent Federal Grades GS5, GS7 and GS9. Only the annual base entrance salaries are used in these calculations. Index figures are adjusted semiannually and published monthly in Civil Engineering. Latest survey was January 31, 1959.

Education and Registration—A Study from the Seattle Section

This is a condensation of a report by the Engineering Education and Registration Committee of the Seattle Section, following up a recommendation of the ASCE Task Committee on Professional Education that Local Sections continue activity in this area.

The Engineering Education and Registration Committee of the Seattle Section has concerned itself with three interlocking problems:

1. How should the current engineering curriculum be modified to meet the requirements of our expanding technology?
2. What should be done to meet the current shortage of engineers?
3. Within the areas covered by this committee, what steps can be taken to advance the profession of civil engineering?

The most important single idea developed by the committee (and the point of greatest unanimity) is that two distinct types of personnel are required to make up the engineering team: (1) the engineering technician, and (2) the truly professional engineer.

In seeking to define more clearly the essential characteristics of these two groups, the committee considered such factors as educational background, function "on the team," and attitude toward the profession. It was generally agreed that it is the individual's attitude toward the profession of engineering that is the most important and easily recognized distinction between the technician and the engineer. The technician, however capable he may be in performing his function, "turns off the switch" at the end of the day, much as any other craftsman. With little or no personal investment in the profession of engineering, he regards himself primarily as a job-holder. He may belong to a union, or he may wish that a suitable union were available to which he could belong, and which would work for his economic betterment. The truly professional engineer, on the other hand, takes not only his technical problems home with him, but also the technical, ethical, and moral problems of the profession.

Closely associated with attitude is the matter of function on the team. The truly professional engineer, because of his greater personal investment in the profession, will inevitably assume the role of leader and administrator and the professional responsibility which that role entails. It is the professional engineer who has the imagination and breadth of vision to conceive engineering works. It is the professional engineer who accepts the responsibility for the design and construction of those works. The technician's role, though a vital one, is clearly of a different nature. The technician merely carries out the orders of the professional engineer, and the responsibility for the accuracy and adequacy of his work is not borne by him, but by the professional engineer.

It is a fundamental weakness of the engineering profession that no real recognition is made of the two basic personnel types by either the engineering schools or the state [Washington] registration board. The engineering colleges, operating on a four-year bachelor's degree program, with grade-point averages the sole requirement for admission or graduation, apparently believe that with a single curriculum they are fulfilling the profession's requirements for technicians and for future professional engineers. Facilities for graduate study are available to assist the able. With the increase in graduate programs of study, there are suggestions that someday the bachelor's degree will be tantamount to a technician's certificate, and one or more graduate degrees will be the mark of the truly professional engineer. At present, this is a meaningless distinction, inasmuch as formal training of any kind is not required for registration, and hence for full professional status as we now define it.

The Washington registration law requires merely a ". . . record of eight years or more of experience in engineering work, of a character satisfactory to the board. . . ." A reading of the Washington law elicits two important and highly significant facts: (1) Experience, not education, is the main factor in professional preparation (a limited amount of education may be offered as a substitute), and (2) graduation per se confers no privileges whatever on the aspiring registrant. Moreover, since the first years of the young engineer's career find him in the role of technician, it follows that experience of this caliber must be acceptable to the registration board. It may be presumed, therefore, that any but the most lowly technician may become registered upon submitting his record of eight or more years of experience in "engineering work" and working a few problems in elementary mechanics on the license examination. He may obtain considerable help from a recent book, *How to Become a Professional Engineer*, by John Constance (McGraw-Hill 1958), and particularly from the chapter on "how to write up an experience record to get the quickest approval." In this regard the committee has been informed by a member of the registration board that the board does not as a rule verify the aspiring registrant's experience descriptions.

The committee is unanimously of the opinion that the basic differences of attitude and function between the technician and professional engineer should not be ignored, but rather, should be defined and developed. The health, the prestige, and possibly the very existence of the profession require it.

The Shortage

If the one-category view of the engineering profession is adhered to it must be concluded that the much publicized shortage of engineers probably does exist. Many leaders in the fields of education and industry believe, however, that the "shortage" is actually two-fold: (1) better engineers, and (2) more technicians.

The steps being taken to resolve the two-fold shortage at any university known to the committee are aimed primarily at producing a larger number of the current product, along with an enlargement of the graduate facilities. Increased output along the present lines of engineering education will probably alleviate the shortage, because the great majority of poorly prepared individuals will end up as technicians, whereas the better students can be encouraged to go on to graduate school, and will thus become the truly professional output of the school.

Perhaps the worst effect of expanded enrollment is that individuals of high potential are forced into an academic lockstep with the low-calibre students, as a result of which their best capabilities cannot be developed.

Engineering teachers must continually water down their course content and spend much time coaching and encouraging the low-potential student to the successful completion of a four-year course of studies, to the great detriment of the students who will eventually become professional engineers, in the fullest sense of the term, and for whom education is of the greatest importance.

The Committee's Recommended Solution

The committee favors a direct attack on the problem, starting at the undergraduate level, as the best means of providing more bona-fide technicians, and at the same time, improving the quality of the engineering graduate. Considerable difference of opinion exists among the committee members as to the specific details that should be recommended, or even as to the amount of detail which should be stipulated at this time.

The following paragraphs present very briefly the essential areas of agreement of the committee.

1. A two- to three-year program of arts and sciences, in which mathematics, physics, chemistry and humanities requirements are fulfilled.

2. Application for admission to a professional school upon the basis of academic record and personal interview.

3. An intensive two- or three-year program of professional studies, leading to a professional-type degree.

4. Individuals who do not gain admission to the professional school, and who so desire, shall receive specific vocational training as engineering technicians, with an appropriate certificate. Some members of the committee believe that the technician's certificate should be granted upon completion of the initial arts and science phase of the course of studies—this is really a minor difference, however.

The committee feels that an educational program of this type would have the following advantages: (1) The period of training required to place a technician on the job would be considerably reduced, as compared with the time required to place a degree-holding technician on the job under the present system: (2) the educational background of the professional caliber engineer will be improved; and (3) the prestige of the profession will be enhanced.

A plan of this type could not be invoked to the advantage of the profession or the public without altering the registration requirements to make the professional-type degree mandatory for registration, and thus prevent the technician from simply calling himself an engineer, and becoming licensed as such.

The registration law can be altered through the efforts of existing engineering societies. As the Washington law now stands, *no* formal instruction is required. This could be made two years, or four years, or graduation, or even the requirement of a graduate degree. In every other profession, completion of a prescribed course of studies at college level is the *sine qua non* of the professional man. Should it not be so in engineering?

If all Founder Societies would support such a program, it would be less difficult to put into effect. However, civil engineers should not depend upon the other societies to help up-grade their profession. If the civil engineering leaders feel that their profession would be enhanced by such changes, they should press for them on their own.

NSPE Celebrates at Anniversary Meeting

At its 25th anniversary meeting, held in New York City this June, the National Society of Professional Engineers declined an invitation to join Engineers Joint Council. This was the second time in six years that NSPE has decided "not to apply for membership in the EJC at this time."

NSPE reaffirmed its belief in the principles of the so-called functional plan, as originally proposed by the American Institute of Electrical Engineers. This plan calls for recognition of separate responsibility, assigning those of a technical nature to the EJC; educational matters to the Engineers Council for Professional Development; and professional activities to the NSPE.

Several public sessions at the meeting were devoted to the theme of the merging role of science and engineering. Speakers did not agree on the paths to be followed but developed some very interesting discussion.

An engineering technicians' committee report recommending establishment of three grades of engineering technicians and one grade of engineering technologist will be given further study before action. The report recommended that the area of concern involving engineering technicians on the part of the various engineering groups should be: ECPD for formal educational development; the various technical societies for technical development; and NSPE for professional status and related problems.

Chosen from among contributors to a special NSPE fund drive, were two "ambassadors" to represent NSPE on a combined fact-finding and good will tour to South America. Selected were Rodney D. Chipp, director of engineering of the ITT Communication Systems, Inc., and his wife Dr. Beatrice A. Hicks, president of the Newark Controls Company and a professional engineer. The trip will be made next spring.

EJC to Issue Newsletter

In its expanding service to the nation's engineers and its own member societies, Engineers Joint Council will publish *Engineer*, a newsletter report on EJC activities, national affairs, and events affecting the engineer. *Engineer* will appear nine times a year, and the first issue is scheduled for September 1959.

The newsletter will bring together news emanating from many sources into a single, comprehensive digest for engineers. It will also give advance notice of EJC's periodic reports in such areas as manpower, engineering salaries, engineering college enrollment, military service for trained manpower, and international events.

Distribution of *Engineer* will be free, and copies will be available to responsible persons and organizations in industry, government, and education. Address Engineers Joint Council, 29 West 39th Street, New York 18, N. Y.

ESPS Moves Chicago Office

The Engineering Societies Personnel Service announces the removal of its Chicago office from 84 East Randolph Street to Suite 812, 29 East Madison Street. The telephone number remains the same, State 2-2748. The change has been made to provide a more central location for the convenience of registrants. There are other ESPS offices in New York and San Francisco.

Judges Named for ASCE Achievement Award

The editors of eight engineering magazines have accepted the invitation of the ASCE Board of Direction to serve on the Jury of Judges to select the "Outstanding Civil Engineering Achievement of 1959." The competition, which embraces all types of civil engineering projects, is designed to make the general public more aware of the work of the civil engineer, and give credit for outstanding civil engineering skills.

Nominations for the award will be made by the Directors of ASCE's fifteen Districts, with the Jury making its selection from these nominations. The winning achievement, subject to approval by the Board of Direction, will be announced at the ASCE Convention in New Orleans in March 1960. The competition is planned as an annual affair, with the composition of the Jury of Judges subject to change each year.

Editors comprising the initial Jury are as follows: William S. Foster, *American City;* Hal Hunt, CIVIL ENGINEERING; Henry Perez, *Construction Methods;* William Quirk, *Contractors and Engineers;* Waldo G. Bowman, *Engineering News-Record;* W. A. Hardenbergh, *Public Works;* Harold J. McKeever, *Roads and Streets;* James I. Ballard, *Western Construction.* Mr. Hunt will serve as chairman of the Jury.

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1960 contest closes May 1, 1960. See 1959 Official Register, page 143.*
FREEMAN FELLOWSHIP:	*1960-61 (closing date pending). See Official Register, page 154, and July 1959 issue of CIVIL ENGINEERING, page 66.*
ERNEST E. HOWARD AWARD:	*Closing date Feb. 1, 1960. See Official Register, page 142.*
ASCE RESEARCH FELLOWSHIP:	*1960 contest closes March 15, 1960. See Official Register, page 156.*
J. WALDO SMITH HYDRAULIC FELLOWSHIP:	*1961-62 (closing date pending). See Official Register, page 156.*

Mining Engineer Wins Alfred Noble Prize

This year the Alfred Noble Prize goes to Paul Shewmon, a young member of the American Institute of Mining, Metallurgical, and Petroleum Engineers, for a paper on "The Redistribution of a Second Phase During Annealing in a Temperature Gradient," published in the AIME Transactions for October 1958. Presentation of the prize to Mr. Shewmon will take place at an early meeting of the AIME. The prize consists of $500 in cash and a certificate.

A 1952 graduate of the University of Illinois, where he received a B.S. in metallurgical engineering, Mr. Shewmon was holder of the Dow Fellowship in Metallurgy at Carnegie Institute of Technology from 1952 to 1955. In the lat-

ter year he received a Ph.D. in metallurgical engineering. He worked in the Metal Physics Group at the Westinghouse Research Laboratory from 1955 to the fall of 1958, and since then has been assistant professor of metallurgy at Carnegie Institute.

The Alfred Noble Prize—a joint award of the four Founder Societies and the Western Society of Engineers—was established in 1929 in honor of Alfred Noble, Past-President both of ASCE and of the Western Society of Engineers.

George Stetson, ASME Editor Emeritus, Dies

George A. Stetson, editor emeritus of the American Society of Mechanical Engineers and *Mechanical Engineering* magazine, died in Stamford, Conn., on June 20, at the age of 70. On the ASME staff from 1928 until his retirement in 1956, Mr. Stetson was credited by his colleagues with raising *Mechanical Engineering* to a prominent position among technical journals and with introducing a number of editorial innovations that have since been widely adopted. He was on the engineering faculties of Yale University and New York University before taking up editorial work.

EJC Ad Series Seeks to Clarify Term, "Engineer"

"Scientists make it known, but engineers make it work!" This is the theme of a series of public service advertisements by Engineers Joint Council, now apearing in *Editor & Publisher*, business magazine for the newspaper profession. The ads are designed to foster understanding of engineers and engineering by printed media, radio and television, public officials, organizations and advertising agencies.

Carrying such titles as "Let's Get Clear on What Engineers Do," "Just Who's Firing Those Missiles" and "Say Engineer When You Mean Engineer!", the ads may help news writers and editors present to the public a better picture of the engineer and what he does. They also will help clear up existing confusion between "scientists" and "engineers," terms frequently used interchangeably.

Robert W. Gerstner Wins ASCE Research Fellowship

Robert W. Gerstner, A.M. ASCE, an instructor in civil engineering at Northwestern University, has been awarded the ASCE Research Fellowship for the academic year 1959-1960. Mr. Gerstner has the distinction of being the first recipient of the fellowship, which was established by the Society last year to meet the need for more basic civil engineering research. The award will be made annually out of current Society income. It carries a grant of $5,000.

Mr. Gerstner will use his grant to work for a doctor of philosophy degree at Northwestern. The problem he proposes to investigate is a determination of the stress distribution in gravity and prestressed dams and their foundations. His project is expected to develop new analytical and computational techniques, which will permit the solution of a large number of associated problems.

Holder of both B.S. and M.S. degrees in civil engineering from Northwestern University, Mr. Gerstner is currently employed as a part-time instructor at Northwestern while working toward his Ph.D. He previously taught at the Chicago Branch of the University of Illinois, and has had two years of experience with various consulting firms and contracting companies.

The Younger Viewpoint

Committee on Younger Member Publications

Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 510 Millburn Ave. Millburn, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	Walter D. Linzing 4751 No. Paulina Chicago 40, Ill.	Rodney P. Lundin 9744 Quakertown Ave. Chatsworth, Calif.

The Far West leads off in this issue, with Rod Lundin of Zone IV reporting.

United Engineering Center

The Member Gifts Campaign for the United Engineering Center is still behind schedule. To younger members who haven't contributed yet, let us take this opportunity to say that even a little bit helps, and contributions are deductible, too. The younger members of the Society should back the campaign wholeheartedly, because they are the ones who will benefit most from this monument to the engineering profession.

The Sections Are Heard From

William B. Horn, of the Tacoma Section, writes, "I believe our younger member paper presentation is worth mentioning. At each regular Section meeting, a younger member is invited to give a 15-minute presentation concerning an engineering project with which he is familiar. At the end of the year the younger member presenting the best paper is awarded a prize of $25.

A newsy letter from Donald W. Fisher, of the Sacramento Section, says in part:

"In an attempt to increase the attendance, a personal touch has been added. Members are being contacted by telephone two or three days before meetings and given a reminder." Instead of omitting meetings during the summer, the Younger Member Forum organizes several field trips in the Sacramento area. Especially important, the group sponsors a review course for those planning to take the state registration exam.

A challenging thought is presented in a letter from Peter G. Hoadley, A.M. ASCE, research assistant at the University of Illinois. His suggestions for improving engineering curricula are excerpted here:

"I propose that when a young student enters college with the idea of eventually becoming an engineer, he be required to follow the course of study leading to a B.S. degree. During these four years the student may acquire a good background in the basic sciences including mathematics, chemistry, physics, and some basic engineering subjects such as engineering drawing, surveying, etc. He may also acquire a good background in the liberal arts, including languages, history, economics, and philosophy.

"Upon completing the requirements for the B.S. degree, he may apply for entrance to an engineering college. . . . He would then embark on two or three years, preferably three, of intensive engineering study, with particular emphasis on his specialty. . . . Upon completing the requirements of the engineering college, he would then receive an engineering degree in his specialty, which would be equivalent to a law degree or medical degree.

"The employer who is interested in hiring a technician could get graduates from the expanding group of technical schools or could employ a person who has only a B.S. degree. . . ."

Mr. Hoadley believes that only a very "radical change" in curriculum will make it possible for the engineer to achieve equal status with the doctor and lawyer.

Another letter, excerpted here, concerns the reasons for the apparent large number of engineers in Civil Service. The writer's name is withheld by request.

"I graduated a year ago from an accredited engineering college of a university, with average grades and a very good final year. At graduation time I went to six or seven interviews of my choice through the Placement Service at the university. My only real requirement was that I wanted to move to California.

"Other than Civil Service organizations, there were no job offers. I then wrote a few corporations in the area that I wanted to work for. None of them had openings at the time. I was married and, like most graduates, in need of money. Consequently, I took a job under Civil Service with the organization of my choice. The fact stands that the starting salary was comparable to that of private corporations and, in some cases, more.

"I am quite aware of the fact that the challenge and the opportunity are more important, but I don't believe recent graduates are in a position to haggle. Starting salaries and ease of job acquirement may be the reason why 40 percent of my graduating class went to work for the California Highway Department."

New Editor for Zone I

Thanks are due to Lou Walter, former Zone I editor, for his contributions before he became overloaded. You will note that Don Kowtko is the new Zone I editor. Your cooperation with Don is requested.

Self-Appraisal Thoughts for the Month

Are my education and cultural background adequate for the realization of my ambitions?

Are my reading habits designed to enhance this background?

What else can I do to improve myself in this area?

Freeman Fellowship Goes to Mechanical Engineer

Willard E. Fraize, a graduate student in mechanical engineering at Massachusetts Institute of Technology, has been awarded the ASCE Freeman Fellowship for the 1959-1960 academic year. As a Freeman Fellow, Mr. Fraize will receive a sum not in excess of $3,000 for his use in pursuing his studies.

A participant in M.I.T.'s Engineering Honors Program, Mr. Fraize is working for a doctor of science degree. The research project that won him the Freeman Fellowship will be the basis for his thesis—an experimental and theoretical investigation of the oscillating airfoil in water. As an M.I.T. undergraduate, Mr. Fraize ranked fourth in a class of 652.

The Freeman Fund was established in 1924 by the late John R. Freeman, Past-President and Honorary Member of ASCE.

THERE MUST BE AN EASIER WAY

DRAFTING ROOM'S DARKEST HOUR— ANOTHER SET OF DRAWINGS TO BE "ONLY SLIGHTLY MODIFIED"
ALL OF THESE WILL HAVE TO BE RETRACED TO GET THE CONNECTING RODS LARGER
IF WE CAN'T HIRE EXTRA DRAFTSMEN THIS WILL TIE US UP FOR WEEKS
I FORGOT WHAT IT'S LIKE TO WORK ON NEW DESIGNS, ALL I DO IS RETRACE OLD DRAWINGS
I FEEL LIKE A GREAT BIG RUBBER STAMP
MAYBE YOU CAN GET SOME GUYS FROM BARNUM AND BAILEY WHO CAN DRAW WITH THEIR HANDS AND TOES
THIS DOES IT! I'M TAKING A JOB WHERE THEY HAVE A BLUEPRINTER MAKE AUTOPOSITIVE PAPER INTERMEDIATES INSTEAD OF RETRACING

Much easier for you—and much more economical, too—when you give even the smallest "retracing" jobs to your print room or local blueprinter.

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Division Doings

Hydraulics Division

There was a record turn-out of 287 for the Hydraulics Division's Eighth Annual Conference, held at Colorado State University, July 1-3. The Colorado Section and Colorado State University, joint hosts to the group, had arranged a social program that made good use of the Rocky Mountain background—a trip to a dude ranch, a Western barbecue supper, and similar diversions. Harold Martin, chairman of the Hydraulics Division, and local committee chairmen Prof. Milton E. Bender and Dr. A. Ray Chamberlain received the special thanks of all for a job well done.

The technical program featured symposiums on Hydraulics Models, Instrumentation, and the Use of Electronic Computers in Hydrology. Visits to the Wind Tunnel, Hydraulics Laboratory, and other test facilities on the campus supplemented the technical program.

President Francis Friel was guest of honor and featured speaker at the banquet, culminating event of the program. At the banquet special recognition was given to three veteran Hydraulics Division members, who have made outstanding contributions to the hydraulics field. Honored were ASCE Past-President J C. Stevens, of Portland, Ore.; Ralph Parshall, of Fort Collins, Colo.; and Ralph D. Goodrich, of Grand Junction, Colo.

The Ninth Annual Hydraulics Conference will be held at the University of Washington, Seattle, in August 1960.

Executive Committee of Soil Mechanics and Foundation Engineering meets to discuss international affairs affecting Division. Seated, in usual order, are T. M. Leps, Chairman S. J. Johnson, Prof. J. Osterberg, and P. C. Rutledge. Standing are R. E. Fadum, John Lowe, III, Ralph E. Peck, and G. A. Leonards.

Soil Mechanics and Foundations Division

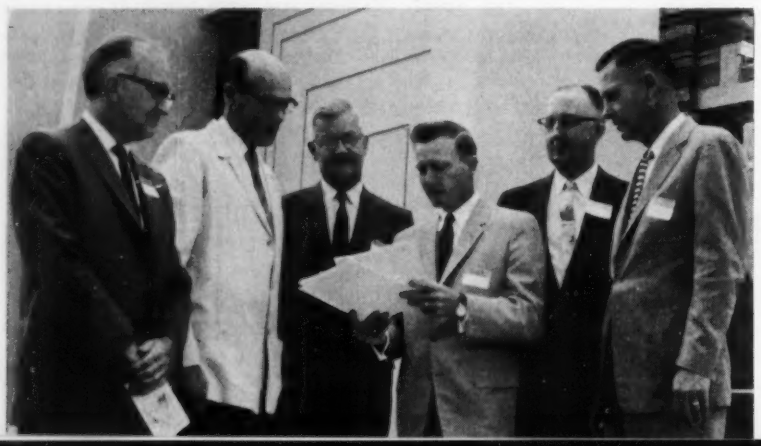
At a recent meeting of the executive committee of the Soil Mechanics and Foundations Division, several decisions regarding international affairs were reached.

The activities formerly carried out by the U.S. National Council on Soil Mechanics and Foundation Engineering, will now be conducted by an administrative committee of the Division, to be known as the U.S. National Committee for the International Society of Soil Mechanics and Foundation Engineering. The membership of this committee will include Division members who were formerly on the U.S. National Council, plus Division members who indicate that they wish to be listed on the roster of the International Society. The executive committee of the U.S. National Committee will be the executive committee of the Division, plus a secretary who will be appointed for two years. John Lowe, III, is the secretary for the current two-year term.

The U.S. unit of the International Group on Soil Sampling, which has been operating since the last International Conference held in London in August 1957, was appointed a Task Committee of the U.S. National Committee. This committee will consist of M. J. Hvorslev, Prof. J. Osterberg, J. O. Parsons, and John Lowe, III.

Papers are requested for the Fifth International Soils Conference, to be held in Paris in July 1961. U.S. authors who wish to submit papers should send a statement of the content of their proposed papers no later than October 1, 1959, to John Lowe, III, Secretary of the U.S. National Committee for the International Society of Soil Mechanics and Foundation Engineering, 375 Park Avenue, New York 22, N. Y.

Get-together of hydraulics experts at the Hydraulics Division Conference includes (left to right) Carl E. Kindsvater, Georgia Institute of Technology; Eugene P. Richey, University of Washington; Arthur T. Ippen, Massachusetts Institute of Technology; A. R. Chamberlain, Colorado State University; Division Chairman Harold Martin, U.S. Bureau of Reclamation, Denver; and Milton E. Bender, Colorado State University.



The scene is South Broad Street, with City Hall in the background.

Laying steel pipe in PHILADELPHIA: 1907

1959—Installing 60-in. tar-enameled Bethlehem steel pipe in Northeast Philadelphia. Contractor: Armour Excavating, Inc.

When the city photographer snapped this pipe-laying crew on Broad Street in 1907, the city was installing nearly 27 miles of steel pipe, in 48-in. and 36-in. diameters. Most of that pipe is still in service—after more than 50 years on the job!

Matter of fact, in Philadelphia they have for many years specified steel pipe for most mains over 30 in. ID.

Today a network of over 3,000 miles of pipe lines supply upwards of 350 mgd to a population now well over two million.

Many of the nation's largest cities, like Philadelphia, use steel pipe for major, large-diameter water mains.

For steady, reliable service, for high flow capacity, for leak-proof joints, for long-range economy—specify tar-enameled steel pipe. Your nearest Bethlehem sales office would be happy to give you full information.

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110-FT. DIAMETER GIANT HOLE is braced by sectionalized 8-in. wide-flange beams, 40 lb. per ft., 21 ft. long, and bolted at the ends. The accurately curved rings by COMMERCIAL back up sheet piling driven in running ground and intermediate layers of water-bearing gravel and boulders.

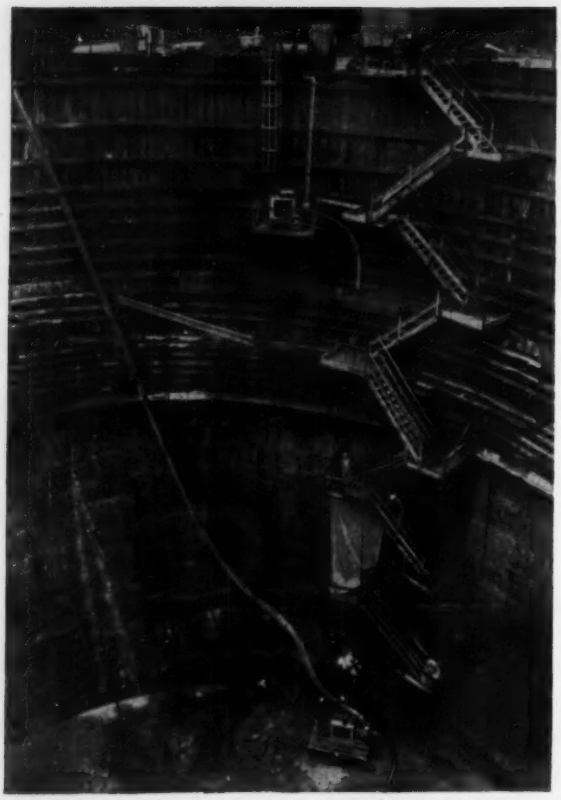


PHOTO COURTESY OF THE JAEGER MACHINE COMPANY

127-FT. DEEP EXCAVATION for the Pittsburgh pump station foundation is shored to meet developing load conditions by COMMERCIAL ring walers installed on varying centers.

Ring walers

World's largest steel-ring walers—engineered by COMMERCIAL—provide unobstructed interior working areas for giant excavations... speed tricky riverside foundation jobs at New Albany, Indiana and Pittsburgh.

The problem: How to excavate deep pits for two different mammoth foundations a couple hundred feet from the Ohio River—without using the time-consuming, expensive conventional lacework of jacks and vertical and horizontal braces which interferes with excavation and concrete pouring.

The solution: Use the world's largest steel-ring walers as designed, engineered and fabricated by the COMMERCIAL SHEARING & STAMPING COMPANY.

The contracting firm of McHugh, Allegheny & Drake did it on a giant, circular-shaped foundation—for a pumping station—on the Ohio River at Pittsburgh, as part of the $100-million Allegheny County Sanitary Authority project.

And it was accomplished on an even larger power station foundation—in the shape of a double cross—being built by

"A DEFINITE SUCCESS", say Charles Brooks, Project Engineer (left) and O. W. Simmon, Superintendent for Gust K. Newberg Construction Co. COMMERCIAL engineered ring walers brace their foundation excavation job — 60-ft. deep, 210-ft. long and 96-ft. wide — on the Ohio River at New Albany, Indiana.

keep large pits completely open

the Gust K. Newberg Construction Co. for the Public Service Co. of Indiana, Inc. at New Albany, Indiana.

In both cases, COMMERCIAL engineers, working with the contractors and project engineers, were able to come up with the answers which spelled faster, interference-free excavation and concrete pouring.

For the full story of how COMMERCIAL steel-ring walers were used in the cofferdam excavation at New Albany, Indiana, send for your copy of Bulletin 300-P1. If you have a similar excavation problem, or if you have a support design challenge involving a shaft, surface or subsurface tunnel project, whatever the size—large or small, we may be able to suggest an equally practical and economical solution based on our more than 25 years of experience in the design of supports for soft ground or rock excavation. Send details to Commercial Shearing & Stamping Company, Dept. C-31, Youngstown 1, Ohio.

PHOTO COURTESY L. B. FOSTER COMPANY

CURVED-WALL COFFERDAM on the New Albany power station project of Public Service Co. of Indiana, Inc. is walled by three intersecting circles of wide-flange beams fabricated by COMMERCIAL — requires only two rows of steel strut bracing.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

Current and future legislation affecting engineers in Alaska was discussed at the June 1 meeting of the **Anchorage Branch** of the **Alaska Section.** Senator Ralph Moody, Representatives Helen Fischer and John Hellenthal, D. B. Slawson, Dan Daugherty and Harry Lee kept the audience's attention for two hours. Singled out were the State Organization Act and the registration of engineers. As regards registration of engineers, present Alaska law would require fairly extensive revision to conform to the State Constitution and to attain the standards of the Model Law which was promulgated by ASCE and other engineering societies with a view to establishing a high standard of engineering throughout the United States. Accordingly, the legislators advised that the desires of the engineers be expressed in the form of a legislative draft accompanied by backup data.

The **Arizona Section's** recent Spring Meeting program, held in Tucson, featured a number of interesting student papers. First place was awarded Roger Turk for his paper on "High-Strength Bolts." Second place went to R. B. Williams for his paper on "The Largest Bridge in China," and third place to Frank Corkran for "Factors Affecting Earthquake Design in Arizona." Another awards winner was Donald L. Chery, the outstanding senior at the University of Arizona and president of this year's Student Chapter. At the noon luncheon Victor H. Kelley, professor of education at the University of Arizona, presented an excellent talk on his impressions of Russian education. The two final papers were on hydrology by David A. Woolhiser and Harold Schwalen, and on expert testimony by John D. Lyons, dean of the College of Law at the University of Arizona. New **Phoenix Branch** officers are James H. Deatherage, president; Earle Morrow Cassidy, vice president; Leon H. Tolleson, secretary-treasurer; and Harvey D. Anderson, junior assistant secretary-treasurer.

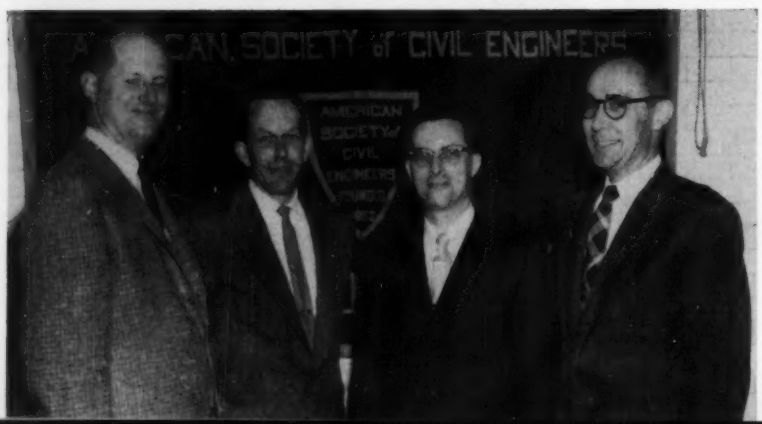
The **Delaware Section** reports that its 1959-1960 officers are Chauncey O. Simpson, president; Anthony J. Maiale, vice president; and George R. McCaulley, counsellor (two years). Holdover officers are James J. E. Boyle, secretary; Joseph A. Santos, treasurer; and Elmars J. Zemetis, counsellor (one year).

The **Illinois Section** is presenting a monthly series of television programs called "Careers in Civil Engineering," which will run through the fall. The five programs will be non-technical since the purpose is to give the lay public an idea of the many things that civil engineers do. The cast is a panel of ASCE members who will employ models and pictures to illustrate their subjects. The first program (July 9) highlighted surveying, photogrammetry and highway engineering.

The **Los Angeles Section** will hold its annual ladies' night dinner-dance on Saturday, Oct. 10, in the Disneyland Hotel. With such entertainers as Walley Bogue and "Sluefoot Sue" from the Golden Horseshoe Review of Disneyland Park and Chuck Marlow and his orchestra signed up, those planning to attend are urged to make reservations well in advance. Contact Bill Kinsey at RAymond 3-6173 (Los Angeles). The first Local Section group activated under the relatively new Pipeline Division is the Los Angeles Section's Pipeline Group, initiated at a June 17 gathering. As part of the initial program Herbert J. Chapton, chairman of the Committee on Pipeline Installation, gave a short introductory talk on the history of the Pipeline Division, its activities, committees, and aims while Walter Cates outlined the constitutional requirements for technical groups. Jack W. Pierce, the first chairman of the local group, introduced the other officers: Joe Siegel, vice-chairman, and Kenneth F. Miller, secretary-treasurer. To close the program an excellent motion picture on the planning and construction of the 22-in. Ozark petroleum products pipeline of the Shell Pipe Line Corporation was shown.

The **Miami Section** is commended for a resolution passed at a recent meeting endorsing and supporting the proposals of the Water Resources Control Committee of the Miami-Dade County Chamber of Commerce for better water control in southern Florida. In its resolution the Section made a number of constructive recommendations to the state legislature, to the state budget director, to the Central and Southern Florida Flood Control District, and to the Corps of Engineers.

Morrough P. O'Brien (left), on the occasion of his retirement as dean of the University of California's School of Engineering, was presented with a testimonial at a recent San Francisco Section meeting. The presentation was made by Section President Harmer E. Davis and expressed the group's "high regard and sincere appreciation" of Dean Morrough's "outstanding services to the university, the engineering profession, and the nation."

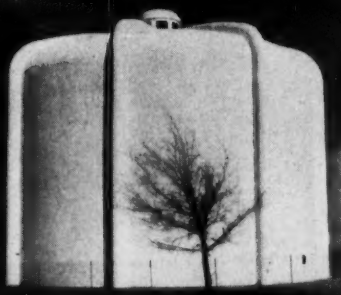


New Mohawk-Hudson Section officers were installed at a recent meeting held in the Union College chapel. They are in usual order, Russell M. Lewis, secretary; William G. Wilkie, first vice president; Haaren A. Miklofsky, president; and Lamar E. Carroon, treasurer. Erhard E. Dittbrenner, second vice pesident, is not shown. George C. Taylor, Jr., of the U. S. Geological Survey, talked about the ground water geology of India, and showed slides on India's topography.

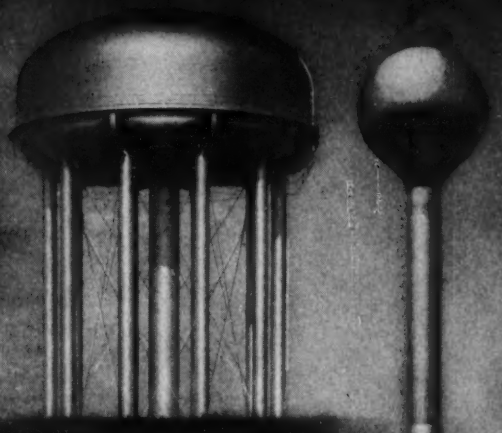
LANDMARKS— of America's Community Growth

Horton® all-welded structures meet the increasing water storage requirements of growing communities by—

- Reducing pressure variations
- Increasing water pressure
- Providing emergency reserves
- Reducing pumping costs



STANDPIPE



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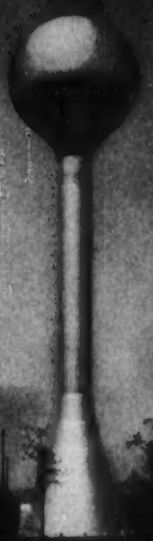
500,000 to 3,000,000 gals.



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WATERSPHEROID®
300,000 to 500,000 gals.

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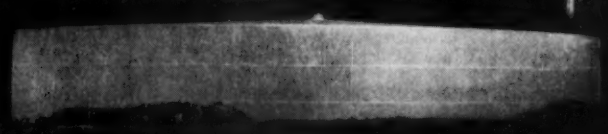

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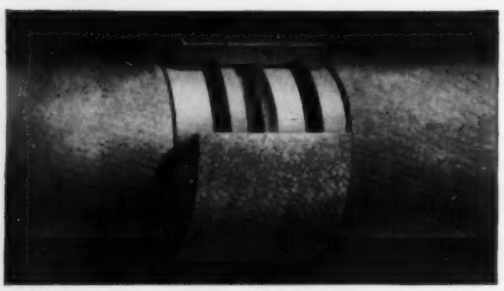
A specific answer to any municipal water storage or pressure distribution problem can be found in the range of capacity and style of structure offered by CB&I in Horton steel tanks. All are built in accordance with AWWA specifications. Write our nearest office for further details.

M42

K&M ASBESTOS-CEMENT PRESSURE PIPE

its bore stays clean year after year



The finest coupling in the industry! Exclusive patented "K&M" FLUID-TITE Coupling connects in two easy steps. Seals tight and stays tight . . . no matter how high the pressure climbs. Sealing rings are self-energizing. No cumbersome coupling puller is required. And, a 5° deflection per coupling if you need it.

"K&M" Asbestos-Cement Pressure Pipe is as *modern* as the Jet Age in which we live. This tax-saver sends maintenance costs tumbling.

The bore remains smooth and clean . . . no clogging and no rusty discoloration of water . . . and pumping costs remain low. Being made of tough, high-tensile-strength asbestos fibers and portland cement, "K&M" Asbestos-Cement Pressure Pipe is practically indestructible. Won't corrode or tuberculate. And, it's completely immune to electrolysis. Joints are permanently, automatically root-tight and water-tight.

for uninterrupted, trouble-free service

"K&M" Asbestos-Cement Pressure Pipe is a thrifty pipe. Its low initial cost is often your last cost. Its lightweight reduces shipping and handling costs.

This thrift carries over into installation. You can install "K&M" Asbestos-Cement Pressure Pipe in practically all kinds of weather and soil conditions . . . with unskilled labor . . . and without heavy machinery. In fact, you can lay more pipe per hour than you've ever done before.

What makes "K&M" Asbestos-Cement Pressure Pipe so special? Eighty-five years of asbestos engineering by one of America's pioneers in asbestos products. Put this wealth of experience to work for you. Write to us today.

K·M
BEST IN ASBESTOS

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Awaiting the arrival of the remaining members of the Wisconsin Section at the start of an hour-long tour of construction projects in the Stadium Interchange of the Milwaukee County Expressway System are (left to right) Robert Dicke and Joseph Looper, of Howard, Needles, Tammen & Bergendoff, Milwaukee; J. F. Emonds, of the Bureau of Public Roads, Donald Leaman (guide), of the Milwaukee County Expressway Commission; and E. L. High, of the Bureau of Public Roads. After the tour the Section's regular dinner-meeting was held. Guest speaker was Henry Wildschut, county expressway engineer and Section vice president.

The recent annual meeting of the **National Capital Section** spotlighted an address by Executive Secretary William H. Wisely on the many facets of Society endeavor. The 140 members, wives and guests also heard a panel of speakers on divers subjects. The Section's incoming officers are W. Orme Hiltabidle, president; Eugene W. Weber, vice president; Daniel P. Jenny, secretary; and John H. Heckathorn, treasurer; and Directors, Bonner S. Coffman and Malcom H. Jones. Outstanding civil engineering students in the area—Hamilton Cecil St. George, Howard University; Lester J. Robinson, George Washington University; and Miguel Ernesto Vijil-Ycaza, Catholic University of America—shared honors as annual spring award winners. At another gathering of the Section, members enjoyed a top-level tour of Capitol Hill improvements and reported they were greatly impressed by what they had seen. The Junior Forum, at its annual meeting, elected Manus J. Fish, president; Edward F. Sullivan, vice president; and Anthony M. Lizzio, secretary-treasurer.

Those attending the spring meeting of the **Texas Section,** held in Corpus Christi, agree that it was "one of the finest" and that the theme, "Development of Water Resources in Texas," was expertly and informatively handled by all the participants. A talk on the economic impact of water development was presented by Harry Burleigh, of the Bureau of Reclamation in Austin, while the lawyer's point of view was given by Durwood Manford, of the Board of Water Engineers. The program highlight, however, was a talk by William Gianelli, assistant director of the California Department of Water Resources, substituting for his immediate superior, Harvey O. Banks. Since California has one of the most forward-looking water development programs in the country, the talk gave the Texans a good idea of what can be done with water resources. Prize winning papers were by Raymond F. Tickner, who presented his entry in the Daniel Mead Prize Contest, and Edwin R. Anderson, of the Southern Methodist University Chapter. Congratulations to the **Corpus Christi Branch,** host for the meeting!

Seen at recent joint meeting of Syracuse Section, and its St. Lawrence Branch, held at Watertown, N. Y., are Warren B. Cavanagh, president of St. Lawrence Branch; Leonard Bellanca, assistant engineer for Modjeski & Masters and featured speaker; Section President Lewis A. Dickerson; and Walter K. Newbauer, first vice-president. Mr. Bellanca spoke on the Ogdensburg Bridge, which was designed by Modjeski & Masters.

ASCE CONVENTIONS

ANNUAL CONVENTION

Washington, D. C.
Hotel Statler
October 19-23, 1959

NEW ORLEANS CONVENTION

New Orleans, La.
Jung Hotel
March 7-11, 1960

RENO CONVENTION

Reno, Nev.
June 20-24, 1960

TECHNICAL DIVISION MEETINGS

IRRIGATION AND DRAINAGE CONFERENCE

Denver, Colo.
Albany Hotel
August 27-29, 1959

Sponsored by
Irrigation and Drainage Division
American Meteorological Society

SIXTH MIDWESTERN CONFERENCE FLUID AND SOLID MECHANICS

Austin, Tex.
University of Texas
September 9-11, 1959

Sponsored by
Engineering Mechanics Division

SANITARY ENGINEERING CONFERENCE

Cincinnati, Ohio
Netherland Hilton Hotel
January 8-11, 1960

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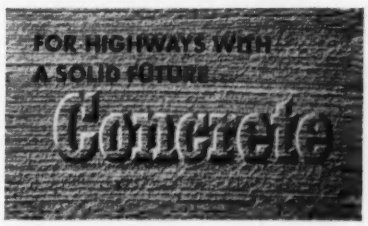
Only CONCRETE roads automatically provide 100% added strength for lasting load-bearing ability!

Laid flat, concrete stays flat. Traffic rides smooth and steady . . . travels fast and far. Modern concrete is the *engineered* pavement . . . designed mathematically to specific wheel load requirements. When you work to accepted design practice, you get a pavement that can support twice the rated axle load . . . a 100% margin of strength.

That's why concrete will stand up not only to rated axle loads in *normal* volume, but even in *peak* volume, with such loads running bumper to bumper . . . and last an expected 50 years and more. Reserve strength like that saves taxes and complaints. It's a big reason why upkeep costs will run as much as 60% lower than for flexible pavement.

Concrete often saves money in other ways, too. For example, on the Indiana Toll Road, engineers drew up designs for both types of pavement, proved concrete would save $9,740,000.

And truckers are the experts who can tell you that today's concrete means gentle treatment of cargoes. It's the flattest, smoothest-riding pavement there is. Small wonder concrete is the preferred pavement for the Interstate System and other heavy-duty highways.



PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

CONCRETE PERFORMANCE REPORT:

POZZOLITH concrete employed in Tri-Dam Project to meet full range of engineering requirements for all types of concrete specified

TRI-DAM

The Tri-Dam Project in south-central California is one of the most interesting hydraulic programs undertaken in recent years. Each of the three structures represents a different basic type of dam being constructed in North America today.

Donnells Dam is a graceful concrete arch. Tulloch Dam is a concrete gravity structure and Beardsley Dam a rolled earth fill dam with a concrete spillway.

Though these three dams were designed to provide year-round irrigation for two agricultural districts, the $52,000,000 in bonds required to finance construction is secured solely by future revenues from the sale of the 84,000 kilowatts generated by the three powerhouses.

Over 500,000 cubic yards of concrete were used in the Tri-Dam Project for tunnels, powerhouses and the dams themselves. POZZOLITH was employed in all concrete except for a small quantity placed during the first few months of construction.

Evaluation tests—Shortly after the project began, laboratory tests were made to determine the quality and economy of concrete produced with POZZOLITH using the cement and aggregate already in use on the project. These tests revealed that mixes made with POZZOLITH Retarder would lower the rate of temperature rise in the mass concrete, reduce the total heat evolved and would provide other basic improvements in quality. Tests also showed that substantial savings would be realized in the cost of concrete.

Field trials with these mixes followed. Careful attention was paid to aggregate coating and workability of the fresh concrete and to strength development under job conditions. The excellent results achieved in the laboratory were repeated in the field, and it was decided to employ POZZOLITH in all concrete at Tri-Dam.

The Beardsley Project—The dam is a rolled earth fill structure 1000 ft. long and 280 ft. high with a concrete spillway. Although the volume of concrete placed at Beardsley was small compared to the other two dams, it provided an opportunity to carefully study the economic advantages obtained with POZZOLITH.

Concreting at Beardsley had been underway several months before the use of POZZOLITH was adopted. During this period some 16,400 cubic yards of plain concrete were placed. Subsequently, 21,700 cubic yards of concrete with POZZOLITH were employed for the spillway, penstock and powerhouse with a net savings of $0.171 per cubic yard or a significant $3,710 on Beardsley. The POZZOLITH mix had the same slump and water-cement ratio as the plain concrete but required a lower water and cement content to achieve the same strength.

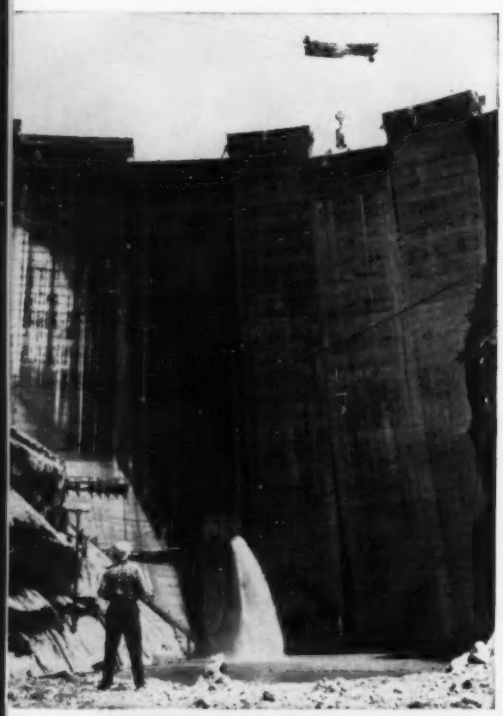
The Donnells Project—The dam is a concrete arch rising 484 feet above its bedrock foundation. Crest length is 960 feet. The spillway structure adjoins the dam on the left abutment.

Approximately 230,000 cubic yards of concrete were used in Donnells Dam and related structures. With POZZOLITH Retarder, 364 lbs. of Type II cement per cubic yard and 6% entrained air, test cylinders averaged 4,000 psi at 28 days.

To hold the temperature of mass concrete at approximately 45° F at the time of placement, the temperature of concrete materials was carefully controlled. During hot weather this was accomplished by circulating cold air through the aggregate bins and obtaining batch water from a cold mountain stream. When the ambient temperature dropped below 35° F, the mixing water was heated and steam was used to warm the sand. In this manner the desired 45° placing temperature was maintained within close limitations.

The Tulloch Project—Tulloch Dam is a concrete gravity structure, 1600 feet in length, having a maximum height of 200 feet.

Though control of heat evolution was desired even during cold weather, it was felt that slow strength gain at early ages might result from the use of a retarder at low temperatures. Laboratory and field tests quickly indicated, however, that with POZZOLITH Retarder, retardation occurred only during the first few hours after placement



DONNELLS DAM rises 480 feet above foundation. This project included construction of a 7-mile long concrete-lined tunnel, penstock and powerhouse.

TULLOCH DAM stretches nearly 1/3 of a mile across the Stanislaus River. Here POZZOLITH Retarder proved particularly beneficial in mass concrete during summer months when the temperature soared up to 110°F.

TRI-DAM FACILITY is jointly owned and operated by the Oakdale and the South San Joaquin Irrigation Districts, California. Design Engineers: George T. Goodall Co. & International Engineering Co., Inc. • Project Engineers: Tudor-Goodenough Engineers • Contractors: Donnells Dam and Beardsley Dam—Tri-Dam Contractors (a joint venture by Morrison-Knudsen Co., Peter Kiewit Son's Co., Macco Corp., and Stolte, Inc.); Tulloch Dam—The Arundel Corp. and L. E. Dixon Co.

requirements were met with substantial savings in cost of concrete—in fact, cost records show a total savings of $172,500 on the entire project.

Throughout the project, Master Builders field men assisted in solving on-the-job problems . . . adding their experience and product know-how to the technical talents and experience of Tri-Dam Project engineers, contractors and concrete suppliers. Result: uniform, better quality concrete at lowest cost in place.

To better meet concreting requirements on your current and future projects—call in the local Master Builders field man. At no cost, he'll demonstrate—with your materials—that POZZOLITH will produce improved concrete . . . superior in performance, in quality and in economy.

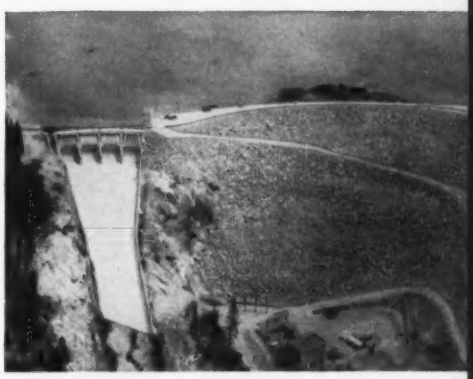
PROJECT

and one-day strengths equaled those obtained with a non-retarded mix at the same temperature.

Most of the 240,000 cubic yards of concrete employed at Tulloch was batched out of a job-site plant. Savings resulting from the use of POZZOLITH approximated $100,000 for an even greater per cubic yard figure than was realized on Beardsley.

Extreme temperature variations —variety of mixes—Concrete work at Tri-Dam extended through all seasons with temperatures ranging from 110° F during the summer to below freezing at night in winter months. A large variety of concrete mixes, mixing methods and placing procedures were employed. Maximum aggregate sizes of these mixes ranged from 3/4 inch up to 6 inches and design strengths ranged from 2,000 to 3,000 psi at 28 days.

POZZOLITH and Master Builders field service—Employed in all but a small part of the 500,000 cubic yards of concrete in the Tri-Dam Project, POZZOLITH effectively aided the placing operation in all situations encountered. With POZZOLITH Retarder, heat generated in mass concrete was reduced and carefully controlled. Strength



BEARDSLEY DAM—an earth fill dam with concrete spillway. Work here demonstrated the lower cost in place of POZZOLITH concrete.

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The Master Builders Company, Ltd., Toronto 15, Ontario • International Department, New York 17, N.Y. • Branch Offices in all principal cities.

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POZZOLITH*

*POZZOLITH *is a registered trademark of The Master Builders Co. for its concrete admixture to reduce water and control entrainment of air and rate of hardening.*

BY-LINE WASHINGTON . . . . .

Look to another new market for consulting engineers, now building up in Washington. It's the National Aeronautics and Space Agency, now headquartered in Dolly Madison's old home across the park from the White House.

With construction appropriations totaling over $53 million for the coming year now tucked away in its coffers, the NASA plans to use outside consultants almost exclusively to draw up plans and specifications for its work. It has virtually no civil engineering staff of its own and doesn't intend to build such a staff. It plans to work on a nearly completely decentralized basis, with each of five "field offices" handling its own engineering and construction projects.

To get on approved lists for invitations, engineers are advised: They must be qualified architect-engineers; must possess military security clearances; must have "safe areas" available in their offices for classified work. Send qualifications and experience records to NASA's Contracting Officer, W. E. Brackett, in Washington, and to the "contracting officer representatives" at Langley Field, Va.; Lewis Research Center, Cleveland, and Ames Research Center, Palo Alto; and to the procurement officers at these bases, and at the NASA High Speed Flight Station, Edwards AFB, Calif., and Goddard Space Flight Center, Beltsville, Md.

Some of the work upcoming this year is sizable: $14 million for further development at Goddard; $10 million for construction incident to a global tracking and communication network; $9 million for expansion of the Jet Propulsion Laboratory at Pasadena; $6.6 million for a data reduction center at Ames; $4.6 million for modernization of facilities at Langley. And there are some others in the way of support facilities.

* * *

It's reported that the Corps of Engineers is now engaged in a major rewrite of its building specifications manuals, to make them conform with existing Air Force specifications concerning fire safety. No date for completion is available.

And on the subject of fire safety, the first meeting of a new group to be directed by the National Academy of Science's Building Research Advisory Committee (and backed by a $40,000 grant from the Ford Foundation) on school fire safety, will be in the nature of a closed session, to organize a working group. Attendance will be by invitation only. No date set as yet.

* * *

The total amount of construction money tucked into various departmental and agency appropriations bills will actually top $3.4 billion.

Some of the breakdown goes like this: Military construction, $1.2 billion for all services; Interior Department (forest roads and trails, Indian affairs, etc.) $100.2 million; Health, Education and Welfare, $199 million; Agriculture, $133.1 million; Veterans Administration, $30.2 million; General Services Administration, $85 million; Atomic Energy Commission, $165.4 million; and NASA (see above), $53 million. The Federal Aviation Agency gets a total of $173.5 million for airport aid (including funds to fulfill current obligations).

Something to watch—Evidence of a growing attack by highway users on water navigation:

- A talk by a top highway-user representative in Washington, with figures to show that cost of highway bridges is upped 27 percent by requirements of navigation (he called it a "hidden subsidy" to water transport).
- A bill (S.1126) to amend the General Bridge Act by requiring the Chief of Engineers "in ascertaining . . . the public interest" to consider "the equal rights of all forms of surface transportation (highway, railroad, waterway and pipeline). . . ."
- Another bill that leaned heavily on the reports of the first Hoover Commission, which recommended that tolls be levied against water transport to help pay for costs of government-furnished waterway facilities.
- Congressman Ben Jensen (R. Iowa) and some supporters, during hearings on Civil Works appropriations, made constant reference to what he called the fact that waterways operators paid nothing—except in ordinary taxes—for use of the facilities provided.

* * *

The current furore in the House of Representatives over the possibly improper employment of retired military officers by "defense contractors" hasn't involved the construction industry, or civil engineering organizations to date. It's not expected to do so. There are a few engineering and construction firms affected, but the positions of these firms were minor in the general investigation—and there's been no strong hint that engineers or contractors have been able to exercise much in the way of influence in the defense field through such employment of high former officers.

* * *

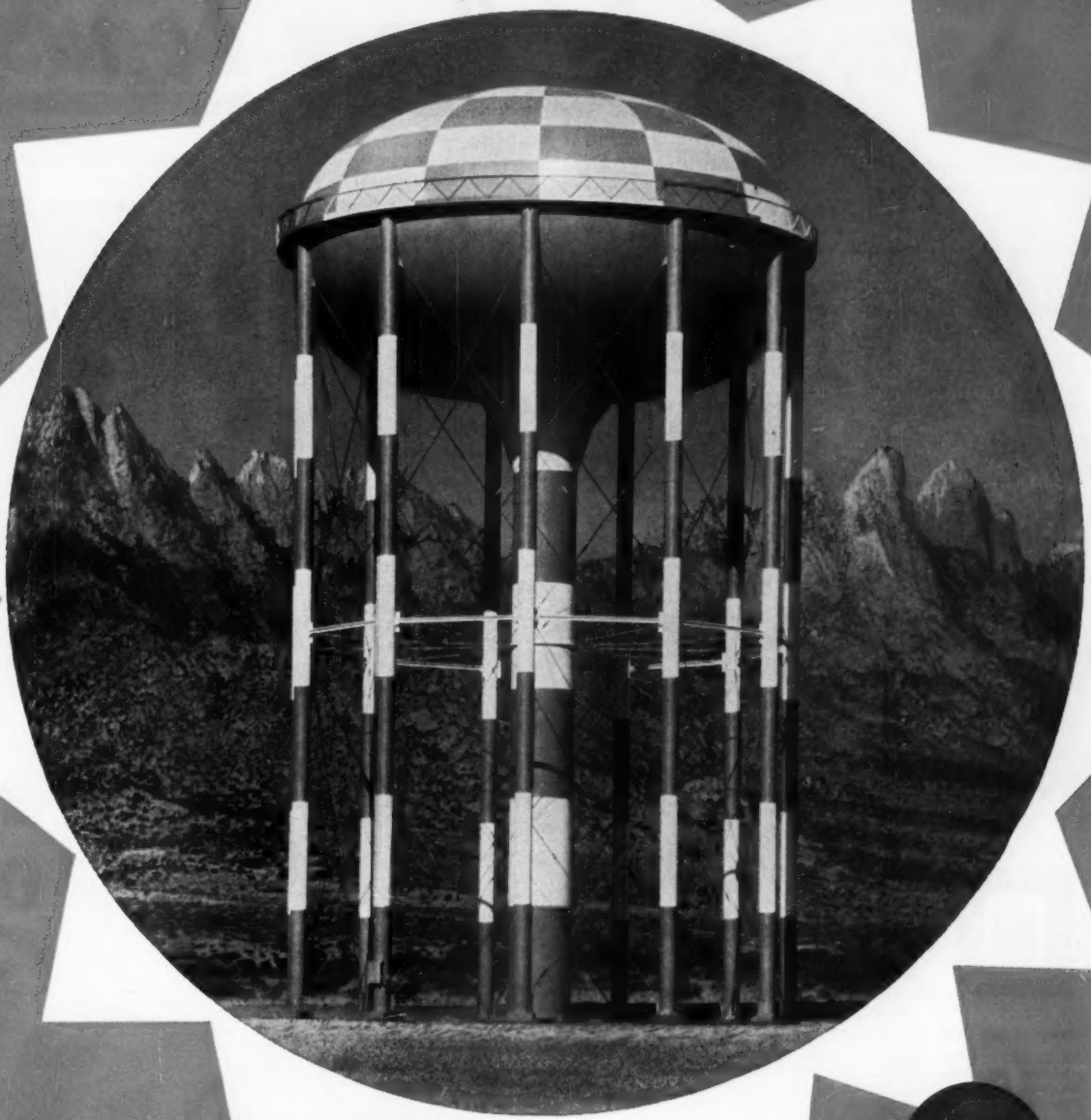
Feeling its strength under its powers to order municipalities directly to clean up stream pollution, the Department of Health, Education and Welfare has ordered a second set of hearings on pollution of the Missouri River—this time looking to cleanup orders in the area around St. Joseph, Mo.

HEW was obviously annoyed by the St. Joseph situation—particularly with failure of city officials to propose new remedies, after voters turned down financing proposals for a waste-treatment plant in the area more than a year ago. The new public hearings, set for July 27, are the second step in HEW's procedure. If a hearing board determines that the city and its industries are in fact polluting the river, HEW can bring court action to compel compliance with its cleanup orders.

* * *

Engineers will want to watch S.2242—a new bill which would authorize the Corps of Engineers to study means of de-icing the waters of the Great Lakes and the St. Lawrence Seaway, to make possible longer operation of these transportation routes. The Corps is directed to bring in a report not later than Jan. 1, 1961, on the results of the survey, together with recommendations, cost studies, and the like. Mentioned specifically are such methods as "bubble systems" to prevent ice formation, use of chemicals, electrical heating.

SOMETHING NEW UNDER THE SUN AT WHITE SANDS, NEW MEXICO



PDM
ELEVATED STEEL TANKS

THIS TORO-SPHERICAL TANK BY Pittsburgh-Des Moines

New design—new economy in purchase for the larger storage capacities. The PDM TORO-SPHERICAL Elevated Tank requires less steel in construction, yet has the same strength and meets the same design criteria as conventional low head range tanks. Pictured is the prototype at White Sands, N.M. Capacity one million gallons, height 99 ft to bottom, head range 35 ft. Write for details.

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SANTA CLARA, CAL.....677 Alviso Road
DENVER (2)....323 Railway Exchange Bldg.

Only proven International® delivers bonus

Blade a bonus load—flip the Shuttle-Bar—and you reverse the TD-15 instantly and reposition fast! New TD-20 and TD-15 owners, the country over, are reporting "next-size-bigger" production from these proven models!

Bonus track roller life really counts for this TD-20 owner, working in the "grinding compound" of water-borne granite particles. Precision-lapped, full-floating, metal-to-metal seals in proven International track rollers provide never-before-equalled protection to keep out abrasives and keep lubricant in!

Years-Proven Planet Power Steering, unequalled undercarriage strength and ease of control make the TD-24 what many contractors call "the rock-dozing special" of all king-sized crawlers. "Live track" steering with both tracks pulling *full time* means bigger loads every push!

International® Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

dependability tough-job performance!

Only International provides heavy-duty-type track-rollers—the "originals," since 1956, with cartridge-type, floating metal-to-metal seals. Only International gives you heavy-duty roller bushings and king-size lube reservoirs, plus husky, big-diameter track roller shafts. Exclusive pressure relief passages guarantee positive prevention of seal blow-out or damage from power lubricators! Measure the advantages of proven International roller design in longer wear life, and downtime prevention!

Only International gives you the proven power-transfer efficiency and design simplicity of sintered metal-faced, dry-type engine clutches. With simple, uncomplicated operation, this heat-defying clutch operates efficiently at all temperatures—reduces lever pull up to 50%—needs no cooling system—delivers proven low upkeep!

Only International gives you proven exclusive cycle-speeding, load-increasing features—that pile up bonus production on tough or easy jobs. Only the TD-24 gives you Planet Power "live" track steering advantages—eliminates "dead-track drag"—pulls or pushes the same big loads on turns or straightaways—gives Hi-Lo power-shifting of either track on-the-go! And both TD-20 and TD-15 give you 6-speed, full-reverse transmissions with "single-stick" shift, and fast Shuttle-Bar forward-reverse control!

Big International crawlers give you smooth, high-torque, proven 6-cylinder diesel performance! You get 6-cylinder smoothness without "balancer" complications! For seconds-fast starting, lightning "load-follow" governing, and fuel-metering accuracy, compare proven International diesels!

See what it means in tough-job performance—and all-job bonus production—to arm your operators with proven International crawler advantages. See your International Construction Equipment Distributor for a demonstration!

New steels are born at Armco

This view of the John C. Lodge Expressway shows dual-beam Armco Guardrail in process of installation in the median strip.

Armco Guardrail Protects Motorists on Two Detroit Expressways

The State of Michigan is a strong advocate of the use of guardrail for the protection of motorists traveling their highways. For example, on Detroit's two famed expressways—the Edsel Ford and John C. Lodge Expressways—a total of 19½ miles of roadway is protected.

Actually, the total amount of guardrail installed is more than double that figure (201,022 feet) since most of it is dual-beam—guardrail on both sides of the posts. This is erected in the median or center strip between the two traffic lanes, and reduces the danger of head-on collisions. Additional rail is used at the entrance and exit ramps, and wherever the flow of traffic creates a safety problem.

In states all over the country, you'll find Armco FLEX-BEAM® Guardrail on many expressways, turnpikes and secondary roads. It is easy to install, provides flexible strength, requires little maintenance. For more data, write for our new FLEX-BEAM Catalog. Armco Drainage & Metal Products, Inc., 7569 Curtis Street, Middletown, Ohio. In Canada: Guelph, Ontario.

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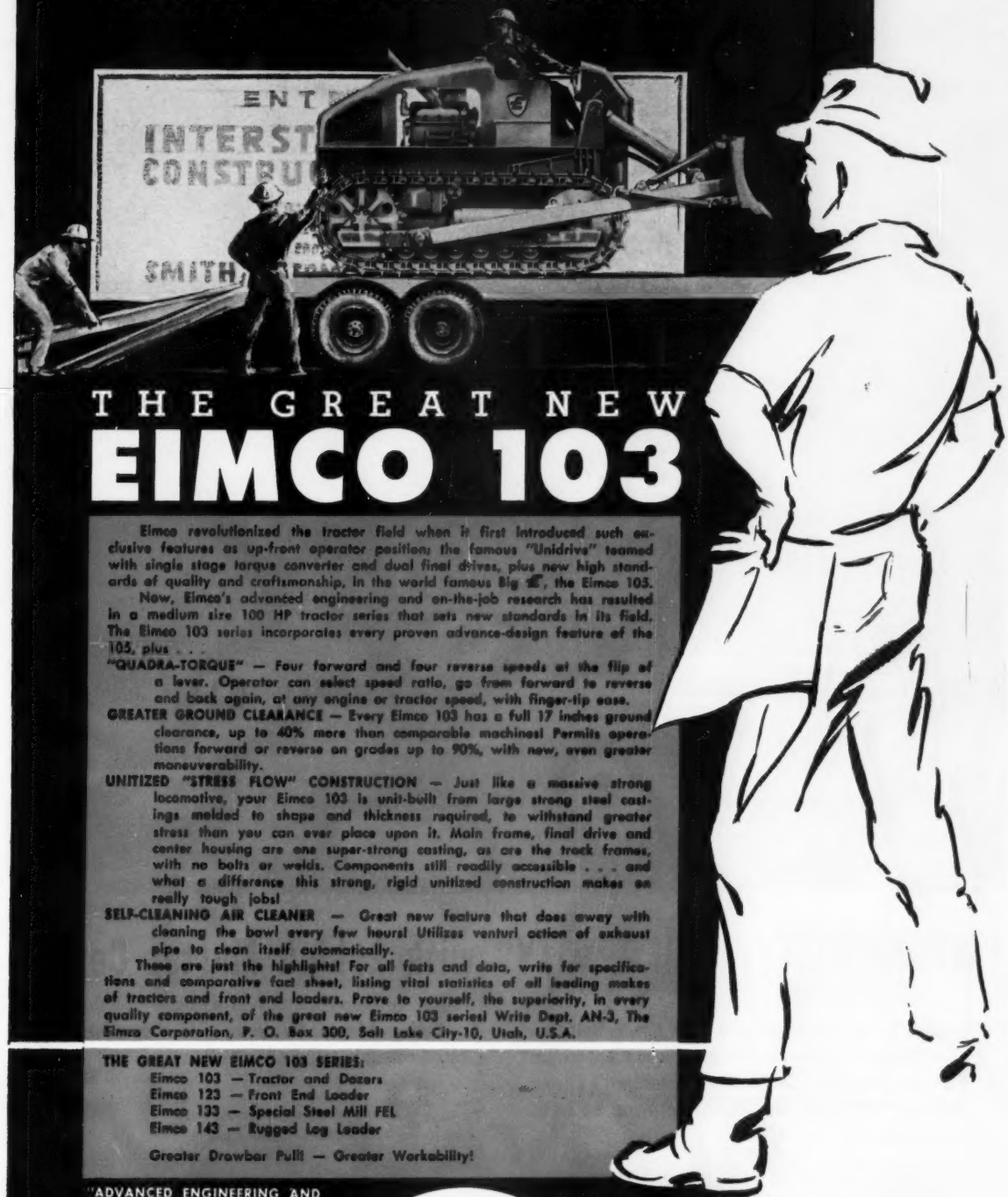

THE GREAT NEW EIMCO 103

Eimco revolutionized the tractor field when it first introduced such exclusive features as up-front operator position; the famous "Unidrive" teamed with single stage torque converter and dual final drives, plus new high standards of quality and craftsmanship, in the world famous Big E, the Eimco 105.

Now, Eimco's advanced engineering and on-the-job research has resulted in a medium size 100 HP tractor series that sets new standards in its field. The Eimco 103 series incorporates every proven advance-design feature of the 105, plus . . .

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GREATER GROUND CLEARANCE — Every Eimco 103 has a full 17 inches ground clearance, up to 40% more than comparable machines! Permits operations forward or reverse on grades up to 90%, with new, even greater maneuverability.

UNITIZED "STRESS FLOW" CONSTRUCTION — Just like a massive strong locomotive, your Eimco 103 is unit-built from large strong steel castings molded to shape and thickness required, to withstand greater stress than you can ever place upon it. Main frame, final drive and center housing are one super-strong casting, as are the track frames, with no bolts or welds. Components still readily accessible . . . and what a difference this strong, rigid unitized construction makes on really tough jobs!

SELF-CLEANING AIR CLEANER — Great new feature that does away with cleaning the bowl every few hours! Utilizes venturi action of exhaust pipe to clean itself automatically.

These are just the highlights! For all facts and data, write for specifications and comparative fact sheet, listing vital statistics of all leading makes of tractors and front end loaders. Prove to yourself, the superiority, in every quality component, of the great new Eimco 103 series! Write Dept. AN-3, The Eimco Corporation, P. O. Box 300, Salt Lake City-10, Utah, U.S.A.

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B—458

After this modern hospital was completed in 1954, the Children's Clinic was added to the right wing in 1958. Lehigh Mortar Cement helped both contractors produce top quality masonry work.

"WORKABILITY—UNIFORMITY" with Lehigh Mortar Cement

Lehigh Mortar Cement was used *throughout* this new Baptist Memorial Hospital in Jacksonville, Florida, including the Wolfson Children's Clinic addition (3rd and 4th stories of wing in right foreground).

Mr. Henry DuPree explains his firm's preference for Lehigh Mortar Cement: "We are well pleased with its sand carrying capacity and workability. It gives us a very uniform mortar and, thereby, a *saving on labor cost*."

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NAYLOR Spiralweld pipe and Wedgelock couplings are always ready for action in construction service. The two go together for lines that are light in weight but heavy on performance. They simplify handling and installation. They give you lightweight lines that are stronger and safer—while saving you time, work and money.

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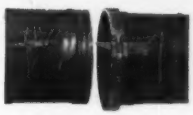
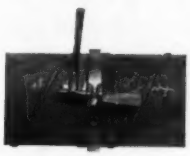
Write for Bulletin No. 59.

How NAYLOR Wedgelock Couplings Speed Connections



1 Drive wedge into two parallel lugs to open coupling.

2 Slip coupling over pipe and put next section in place.



3 Drive out opening wedge so coupling snaps into place on grooved ends of pipe.

4 Drive wedge home into the three lugs on coupling. A hammer is the only tool needed.

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NEWS BRIEFS . . .

June Construction Activity at New High for Month

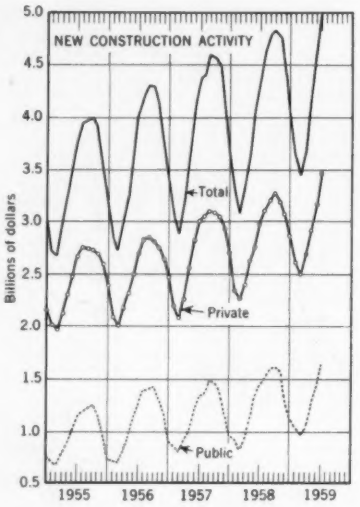
New construction activity expanded seasonally in June, bringing the total value of work put in place to a new high of $5.0 billion for the month, and $24.9 billion for the January-June period, according to preliminary joint estimates of the U.S. Departments of Labor and Commerce. The totals for both June and the first six months were up 15 percent from a year ago. Spending for new construction thus far in 1959 has been at a seasonally adjusted annual rate of $55.1 billion, compared with actual outlays of $49.1 billion for the entire year of 1958.

Preliminary information available through May 1959 indicated that the overall physical volume of new construction put in place this year (expenditures adjusted for price changes) was 12 percent above the amount placed in the first five months of 1958.

Private outlays for new construction in the January-June 1959 period reached a record $17.5 billion, mainly because of a 32 percent expansion in residential building (to $10.2 billion) over the first half of 1958. However, this year's May-to-June increase in residential construction was less than seasonal, whereas most major types of private nonresidential building (including industrial construction) expanded more than usual for the time of year.

Public construction expenditures for the first six months of 1959, at $7.4 billion, were 14 percent above the same 1958 period, chiefly because of over-the-year increases in spending for new work on highways, housing, and military construction.

The monthly estimates of the joint agencies are determined primarily by past contract award movements, standard progress patterns, and assumed normal seasonal movements. Except when special surveys are made, the estimates do not reflect the effects of varying numbers of working days in different months, nor of special conditions influencing the volume of activity in any given month, such as unusual weather, materials shortages, overtime, work stoppages, and postponements. Other month-to-month measures of current construction activity are employment, hours of work, and unemployment.



Seasonal expansion of construction activity in June brings total to $5.0 billion—a record high for the month. January-June total is $24.9 billion.

Consultant Fees and State Practices Challenged

Pushed by the powerful U. S. General Accounting Office—which is critical of contract practices concerning consulting engineers—the Bureau of Public Roads is now in the process of revising its policies on consultant contracting for federal-aid highway projects.

Policy revisions now under consideration would require: Stating the qualifications of consultants to be used on federal-aid work; a revision of the fee base for consultant contracts; and putting consultants under state supervision in highway work.

In a separate action, BPR is being pressured by the GAO to try to put an end to the state practice of announcing engineers' estimates of costs, prior to bidding on federal-aid highway work.

Both actions are a result of a report of an audit of BPR's activities for 1957 and 1958, filed with House and Senate public works committees in mid-June by the Office of the Comptroller General of the U. S.

Generally friendly in tone, the report is, however, highly critical of some practices of BPR and of the states under the 1956 highway act. It criticizes BPR accounting practices, among other things, as well as state procedures in qualifying contractors, acquisition of right of way, and other matters.

"We have noted," says the GAO report, "that fees for consultants generally are based upon a stipulated percentage of awarded contract prices, or estimated construction costs. For the year 1956 and 1957, more contracts were negotiated at 4 percent than at any other figure. "Fees computed on this basis ranged up to $3,655,000 for a single project.

"This method of contracting places the consultants in an advantageous position. Since fees will vary in proportion to awarded contract prices or estimated construction costs, there is an incentive for consultants to prepare elaborate plans and specifications, and design expensive structures to increase their fees.

"We recommend that the Bureau review the various types of contracts for consultants' services . . . with a view toward elimination of such features as are not conducive to reasonable control of costs and fees."

The audit report estimated that fees for consultant contracts totalled about $114 million in the calendar year 1957.

The practice in six states (during 1958) of publishing or otherwise disclosing engineers' estimates of project costs prior to bidding, was also singled out by the accounting office as a bad practice. "In our opinion (this practice) may act to restrict competition and influence bidders' prices," said GAO.

"In view of the apparent inconsistency on this matter among the states . . . we recommend that the Federal Highway Administrator seek the cooperation of those states whose policies provide for advance publication of engineering estimates . . . to eliminate this practice in connection with all federal-aid highway construction projects."

Contract Awarded for Building Cougar Dam

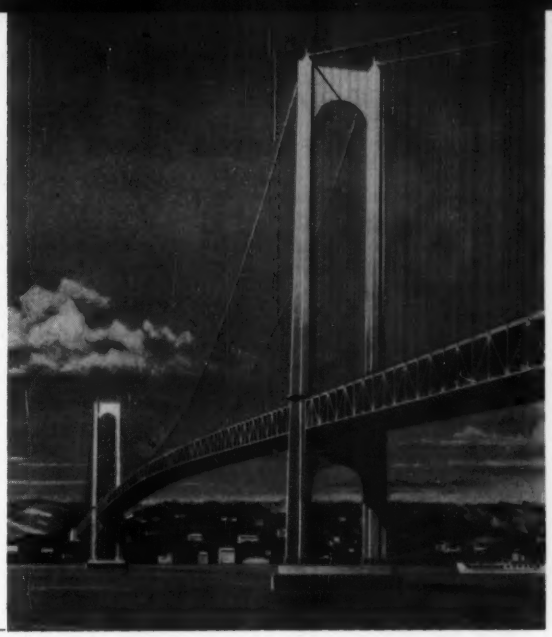
Award to the Merritt-Chapman & Scott Corporation of a $23,985,564 competitive contract for the construction of Cougar Dam has been announced by the Corps of Engineers. The contract award was made by Col. Walter L. Winegar, Portland district engineer.

Located on the South Fork of the Mackenzie River 42 miles from Eugene, Ore., Cougar Dam will operate as a unit of the coordinated flood control reservoir system planned for the Willamette River basin. Its reservoir will provide 155,000 acre-ft of storage for flood control and other uses, and the powerhouse will have two generators with total installed capacity of 25,000 kw. The dam will be a rock-fill-type embankment, 1,500 ft long, with maximum height of 445 ft from foundation to crest.

Merritt-Chapman & Scott is currently building three other major dams in the West: Glen Canyon Dam, a Bureau of Reclamation project on the Colorado River at Page, Ariz.; Priest Rapids Dam on the Columbia River for the Grant County (Wash.) Public Utility District; and Gorge High Dam on the Skagit River at Newhalem, Wash., for the Seattle Department of Lighting.

Bosporus Bridge to Connect Europe and Asia

World's first intercontinental bridge will be this $50,000,000 suspension structure connecting Europe and Asia across the Bosporus at Istanbul. The design and plans are now being completed by New York City Consultant D. B. Steinman, F. ASCE. Test borings recently made at the bridge site revealed that the rock gorge under the Bosporus is wider than originally anticipated, necessitating an increase in the main span from 2,214 to 3,091 ft. There will be two side spans of 681 ft each, making the bridge one of the largest in the Eastern Hemisphere. The two arched steel towers will rise 520 ft above the water. The central portion of the main span will provide vertical clearance of 164 ft for the passage of international shipping. The bridge is a major feature of the Turkish Government's highway modernization program.



Brazil Starts Port Development Program

An ambitious program of port development and maintenance is being undertaken by the Brazilian Government to combat the effects of serious silting that is hampering navigation. To expedite the country's port rehabilitation program, the National Bank for Economic Development, acting for the Brazilian Ministry of Transport and Public Works, has contracted for $5,500,000 worth of dredging equipment from the Ellicott Machine Corporation of Baltimore, Md. The order includes delivery of two 24-in. hydraulic pipeline dredges, each with a total of 5,000 hp, plus renewal equipment for modernizing one existing hydraulic pipeline unit and two sea-going hopper dredges.

Sixteen major harbors, ranging from Belem at the mouth of the Amazon River to Rio Grande near the Uruguayan border, are scheduled for rehabilitation by the dredging fleet. The program was developed after an extensive survey of the ports, in which Ellicott engineers assisted.

ASME Nominates Walker Cisler for President

Walker L. Cisler, president of the Detroit Edison Co., is official nominee for president of the American Society of Mechanical Engineers. Mr. Cisler heads a slate of four vice-presidents and three directors chosen by the organization's nominating committee. New officers will be installed during the ASME's annual meeting in Atlantic City in December, following confirmation of the slate by mail ballot of the membership.

Prominently identified with power industry developments during his long career, Mr. Cisler has done much to further the growth of atomic energy as a power source. He has been executive secretary of the Atomic Energy Commission Industry Advisory Group and president of Atomic Power Development Associates, Inc., the Fund for Peaceful Atomic Development, Inc., and the Power Reactor Development Company.

More and Better Water Aim of WHO Program

A resolution to provide safe and adequate supplies of water for communities all over the world was unanimously adopted at the recent twelfth World Health Assembly, held in Geneva under the auspices of the World Health Organization. In introducing the resolution, Dr. M. G. Candau, director-general of WHO, emphasized that a supply of potable water "is the foundation on which rest the health and economic well being of the community." Because of the basic public health importance of community water supplies, he continued, "WHO cannot remain aloof from its obligation to supply the stimulus and assistance needed to bring about their construction."

The acute nature of the water supply problem in many countries was pinpointed in a radio broadcast by William E. Wood, chief water engineer to the Government of Northern Nigeria. Using Nigeria as a typical example of an arid country, Mr. Wood noted that he is responsible for providing water to more than 18,000,000 people scattered over a 250,000-sq mile area. Though the government has built and is building a large number of community water supplies, ranging from small village systems to large urban installations, many villagers have no water at all for six months of the year, except foul supplies collected from open and contaminated pools during the wet season and stored in earthen pots in their dwellings. Even when shortages are not acute, Mr. Wood went on to say, "it is a common occurrence for the women and children to have to walk several miles, with heavy pots of water on their heads, to obtain minimum supplies for their families. Ironically, too, this water, obtained by so much labor and hardship, is frequently the cause of sickness from bacteria or parasites."

The resolution adopted by the World Health Assembly asked the Director-General "to continue his study of ways and means of assisting governments to provide safe and adequate supplies of water to inhabitants of their communities, including an investigation of existing international loan or other funds which might be available for investment in such facilities." It also asked the member states of WHO to give priority in their national programs to the construction and extension of supplies of safe water to communities, and suggested that "within each country requiring such a facility a revolving fund be established to provide loans for water supply development to local agencies of governments."

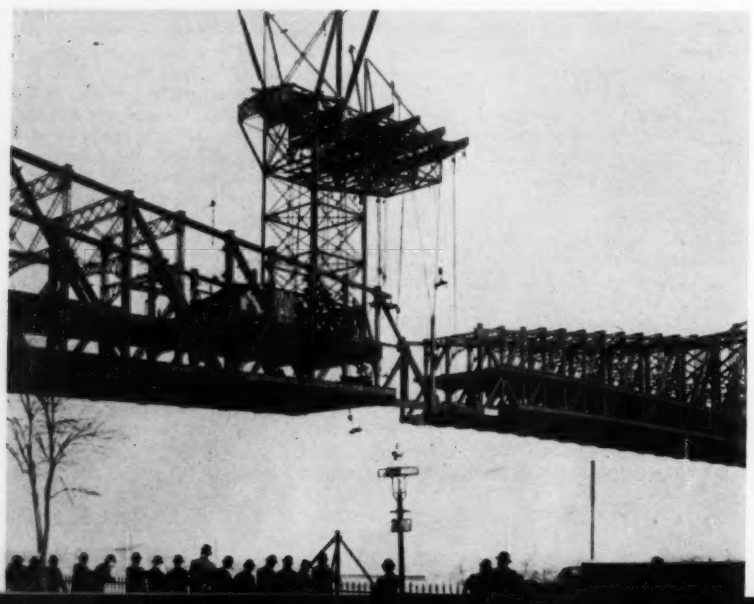
Creation of a Community Water Supply Special Fund was also decided upon. This fund, which is to be financed by contributions, will help the governments draw up plans for providing public water supplies. Finally all multilateral and bilateral organizations working in the international field and interested in such developments will be invited to cooperate with WHO in carrying out its global program. The new activity will have top priority in WHO's environmental sanitation program.

H. G. Baity, F.ASCE, director of the WHO Division of Environmental Sanitation, sees the global water supply program as promising "much for the future health and economic progress of the world."

Busy New York Bridges Celebrate 50 Years of Service

Two of New York City's busiest bridges are completing half a century of service this year. They are the Queensboro, one of the great cantilever spans, and the Manhattan, the first suspension bridge built in accordance with the deflection theory. This year the two bridges will transport an unprecedented 75,000,000 vehicles across the East River, making them the two most heavily traveled bridges in New York City. Neither of the bridges has required strengthening during their half-century of service, though they carry what has become one of the heaviest traffic burdens in the world.

The Queensboro Bridge, connecting Manhattan at 59th Street with the Borough of Queens on Long Island, is a continuous double-cantilever of unequal spans. All the supporting piers are built on land, the two center piers being located on Welfare Island (formerly Blackwell's Island) in the middle of the East River. The two cantilever or main spans of the bridge measure 1,182 ft and 984 ft, while the middle span is 630 ft long. To provide extra strength without additional weight, it made the first extensive use of nickel steel for tension members and pins.



The narrow trusses and graceful curve of its four suspension cables characterize Manhattan Bridge (top photo). Its design was greatly influenced by the first major use of nickel steel in trusses. Lower view shows turn-of-the-century sidewalk superintendents in their derbies watching the last link in one of the cantilever spans of the Queensboro Bridge set into place. Photos courtesy of New York City Department of Public Works.

Since the nickel steel was 50 percent stronger than ordinary carbon steel, it was utilized in the 48-in.-deep eyebars that form the top chord of the bridge. Some 6,000 tons were used. The eyebars are arranged side by side and pinned at both ends to form a chain varying in width from 60 in. at the main piers to 24-in. at the middle of the span. It was estimated that an increase of 40 percent in sectional area would have been required without the use of the new steel, which contained 3¼ percent nickel. Today of course, more highly developed nickel-bearing alloy steels provide the same extra strength and corrosion resistance at lower cost.

The shore, or anchor arms, and the island span of the bridge were erected by means of steel falsework—quite a novelty at the time. The two channel spans were cantilevered out by two giant travelling cranes.

The finished bridge was thought to be cumbersome looking by many architects of the day. None the less the Queensboro Bridge has served its purpose admirably, and today many New Yorkers are genuinely fond of its homely look of strength and permanence. It was designed by one of America's great bridge designers, David Lindenthal, while he was Commissioner of Bridges of New York City.

The spirit of the Gay Nineties still lingered when the Queensboro Bridge was dedicated on June 12, 1909. Old photographs taken on glass plates and carefully preserved over the years show the bridge promenade crowded with well turned-out ladies and gentlemen.

The same enthusiastic and festive welcome was showered on the graceful and slender Manhattan Bridge when it was dedicated the same year. Designed by engineers of the New York City Department of Bridges, assisted by architects, Carrete and Hastings, the Manhattan Bridge made use of 8,000 tons of the new nickel steels in its then-unprecedented narrow trusses. The general dimensions of the structure were greatly influenced by the use of the high strength-to-weight ratio of the steel.

An ingenious method, employing derrick platforms, was used to hoist sections of the tall bridge towers into place. As each section was added to the towers, the derrick platforms hoisted themselves to the next level and began hauling up another section.

The towers themselves were designed to bend with the changing stresses on the four 21-in. suspension cables. In all, the Manhattan Bridge cables contain 24,000 miles of wire, strung and spun between August and December 1908—considered a sensational record for the day.

Today the toll-free Queensboro Bridge is the most heavily traveled span in New York, carrying over 100,000 vehicles a day. The Manhattan Bridge runs a close second with nearly 90,000 vehicles.

(Vol. p. 594)

Stiff Challenge Faces Educators at ASEE Meeting

Achieving quality as well as quantity in education is the challenge facing American engineering education. The caliber of education for larger numbers of students was stressed during the sessions of the 67th annual meeting of the American Society of Engineering Education, held at the University of Pittsburgh and Carnegie Institute of Technology, June 15-19. More than 2,200 delegates from the nation's leading colleges and universities attended the sessions.

Dr. Eric A. Walker, president of Pennsylvania State University, sounded the keynote for the future of engineering education by calling for a recognition of "the responsibilities for professional morality as well as for professional competence."

The development and application of new knowledge in engineering were cited by Dr. Harold L. Hazen, dean of the Graduate School at Massachusetts Institute of Technology, as placing "heavier demands upon the intellectual qualities and attainments of our future engineering faculties. More than ever," he said, "the life of the professor must be the life of a student."

Scientists and engineers must accept greater responsibility for the social problems which they have helped to create. Dr. Dael Wolfle, executive officer of the American Association for the Advancement of Science, called on the ASEE "to make such contributions as we can to the planning of the social and economic framework in which the engineer of tomorrow will work."

To provide quality in education for greater enrollments, Dr. Wolfle made three specific recommendations:

1. There must be greater support—moral as well as financial—for social science, emphasizing the most fundamental work in the social studies.

We must do better social, economic, and educational planning, so that we can better foresee the problems which scientific developments will pose for us and the environment in which they will require solution.

3. We must encourage social innovation.

Dean William T. Alexander, of Northeastern University's College of Engineering, declared that the excellence of all American education is the personal responsibility of every intelligent American citizen. "We must recognize that the quality of preparation in the secondary schools, generally speaking, will control the rate of progress of the undergraduate, and this in turn affects the maximum level of sophistication which can be reached in graduate school."

In discussing engineering curicula, he said there must be improved educational value. "Far too many of our courses put a premium on keeping the students busy rather than insuring a maximum of student thought. We must permit and encourage our faculties to maximize the thinking content of their courses."

An ASEE committee report on the loss of faculty to industry was made by Prof. A. R. Hellwarth, assistant to the dean of the College of Engineering at the University of Michigan. The survey of 235 college teachers in engineering subjects who left their schools in the past five years shows that security, covering income and fringe benefits, was the dominant factor in taking an outside position.

The report indicated that 70 percent of those engineering faculty who left their schools for outside interests had been on the staff for three to fifteen years, were 25 to 40 years old, and in most cases were considered permanent faculty members. The report suggested to administration heads, "the desire of the teacher to continue his relationship with his school will be a reflection of the school's interest in him and its recognition of him as a professional man with all the economic and social benefits pertaining thereto."

Benjamin R. Teare, Jr., dean of the College of Engineering and Science at Carnegie Institute of Technology, took office as president of the ASEE at the end of the meeting. The new vice-presidents are Ralph G. Owens, dean of engineering at the Illinois Institute of Technology; Howard W. Barlow, director of Washington State Institute of Technology; and Harold E. Wessman, F. ASCE, dean of the University of Washington College of Engineering. William P. Kimball, F. ASCE, dean of the Thayer School of Engineering, will be secretary, and Wendel W. Burton, employment manager for the Minnesota Mining and Manufacturing Company, treasurer.

Atomic Electric Plant For Consumers Power Co.

The Consumers Power Company will build an atomic plant on Lake Michigan at Big Rock Point, Mich. The reactor will be a direct-cycle, forced-circulation, boiling-water unit capable of producing 50,000 kw of electricity. Its primary objective will be the development of engineering and economic data on high power density and high specific power. First operation of the unit is planned for 1962. The cost of the proposed plant and its related facilities has been put at $30,000,000, or $10,000,000 more than the cost of a conventional plant of similar capacity.

The plant, including the conventional power generating equipment, will be engineered and constructed by the Bechtel Corporation, of San Francisco, the prime contractor, with General Electric supplying the nuclear reactor, instrumentation, nuclear fuel, and power generating equipment. Commonwealth Associates, Inc., of Jackson, Mich., will provide engineering services for certain facilities.

Consumers Power will undertake an extensive research and development program on reactor core and fuel design in cooperation with General Electric. The goal will be to increase the capacity of the plant after it goes into operation from the initial 50,000 to 75,000 kw through refinements in technical developments. The new plant is one of five key developmental boiling water plants, which are part of a suggested General Electric "Operation Sunrise" program for attaining economically competitive nuclear power plants by 1965 in areas of high fuel cost.

Boiling-water reactors are receiving wide acceptance as the type most likely to produce economically competitive power. A 150,000-kw plant of this type will be built in Italy for the Societa Elettronuclear Nazionale. Smaller units are being planned by West Germany, Switzerland, and Japan.

Steel Erection for Chase Manhattan Bank Building

More than 80 percent of the 52,000 tons of structural steel required for the 820-ft Chase Manhattan Bank Building has already been erected by the Bethlehem Steel Company. The 16-ton load seen rising here consists of four 45-ft girders destined for the 41st floor of the 60-story building. Total steel tonnage required is the largest for any similar New York structure with the single exception of the Empire State Building, which required 58,000 tons. The Turner Construction Co. is the general contractor for the building, which occupies a block in lower Manhattan. The target date for completion is mid-1960.

European Congress on Building Research

Engineers and others interested in building progress are invited to attend the International Congress on Building Research Studies and Documentation, to be held in Rotterdam, September 21-25, under the auspices of the International Council for Building Research Studies and Documentation. The ten subjects slated for study will be devoted to both fundamental and applied building research and also to the transmission of knowledge about building through documentation.

Topics will be presented by such experts as Prof. E. Torroja, F. ASCE, director of the Instituto Tecnico de la Construcion y del Cemento, Spain, who will present the subject, "The Design and Calculation of Safety Factors for Structures"; Prof. G. Kutznetsow, of the USSR Academy of Building and Architecture, and Dr. N. Jacobsson, director of the Swedish State Committee for Building Research, who are collaborating on the subject of "Research Problems Relating to the Use of Heavy Concrete Elements"; and L. M. Giertz, architect-director of the Swedish Institute for Building Documentation."

Further information about the congress may be obtained from Mr. J. de Geus, Secretary-General of the C.I.B., c/o Bouwcentrum, P.O. Box 299, Rotterdam, Netherlands.

Raymond International To Build Road in Kenya

The Government of Kenya, East Africa, has awarded an $11.5 million contract for construction of 300 miles of road to a joint-venture group, consisting of a Raymond overseas subsidiary, Raymond International (U.K.) Ltd., London, and the Mowlem Construction Company, Ltd., of Nairobi, Kenya. Work has already started on the four-year project, which involves about 50 miles of new paved road and 250 miles of rehabilitation and surfacing of existing road.

Iran Receives Large Loan for Highways

The World Bank's biggest loan for highways ($72 million, U. S. money) has recently been made to Iran. The loan will help finance the construction and reconstruction of 1,500 miles of main roads in western and southern Iran, the improvement of a 270-mile link connecting the important Shiraz Province with the Gulf ports of Khorramshahr and Bandar Shapur; and planning feeder and main roads to be included in Iran's next highway program.

The major feature in the country's current road-building program is improvment of the 750-mile Trans-Iranian Highway, connecting the port of Khorramshahr on the Persian Gulf with the port of Pahlavi on the Caspian Sea. Improvement of this road, which requires reconstruction and relocation, will also improve connections between these centers and Teheran, the capital. Over a million tons of cargo is carried over the Trans-Iranian Highway annually.

Total cost of the road program, which is scheduled for completion by mid-1962, is $185,000,000. The World Bank loan will cover foreign exchange requirements. Work will be carried out by the Iranian Plan Organization, the nation's economic development agency.

Details on the program are reported in the July issue of *World Highways*.

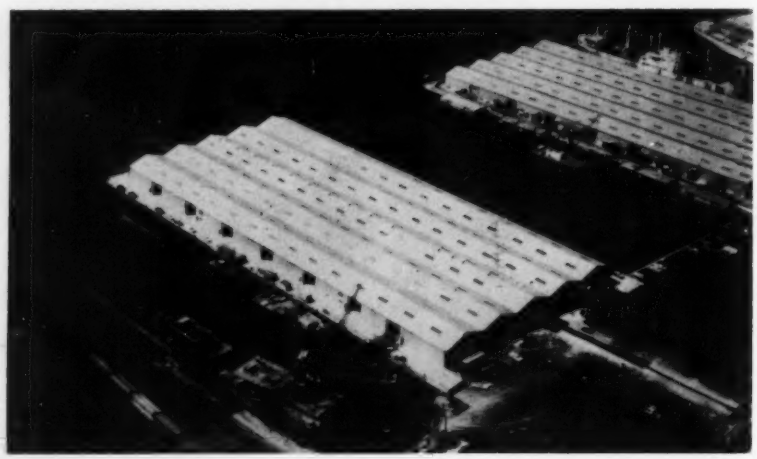
Modifications Made In Aswan Dam Plans

Plans made by the Soviet Union for constructing the first stage of the long-awaited Aswan High Dam have been accepted by the Egyptian government. However, several modifications have been made in the Soviet design, which are expected to reduce the cost by some $17,000,000. With this reduction, the first stage project will be $71,750,000.

The design changes include construction of six tunnels where an open canal had been originally proposed; changes in the design of the gates; reduction in the length of the dam; and a change in the location of the electrical generating plant.

The Aswan Dam—a fifteen-year project for harnessing the Nile waters at a point about 550 miles south of the Mediterranean coast line—will be 250 ft high at the center and more than three miles long, making it one of the biggest single construction projects yet devised. Construction will be supervised by Dr. Hassan Zaki for the United Arab Republic and Ivan V. Komzin for the Soviet Union.

New Pier Opened on Brooklyn Waterfront

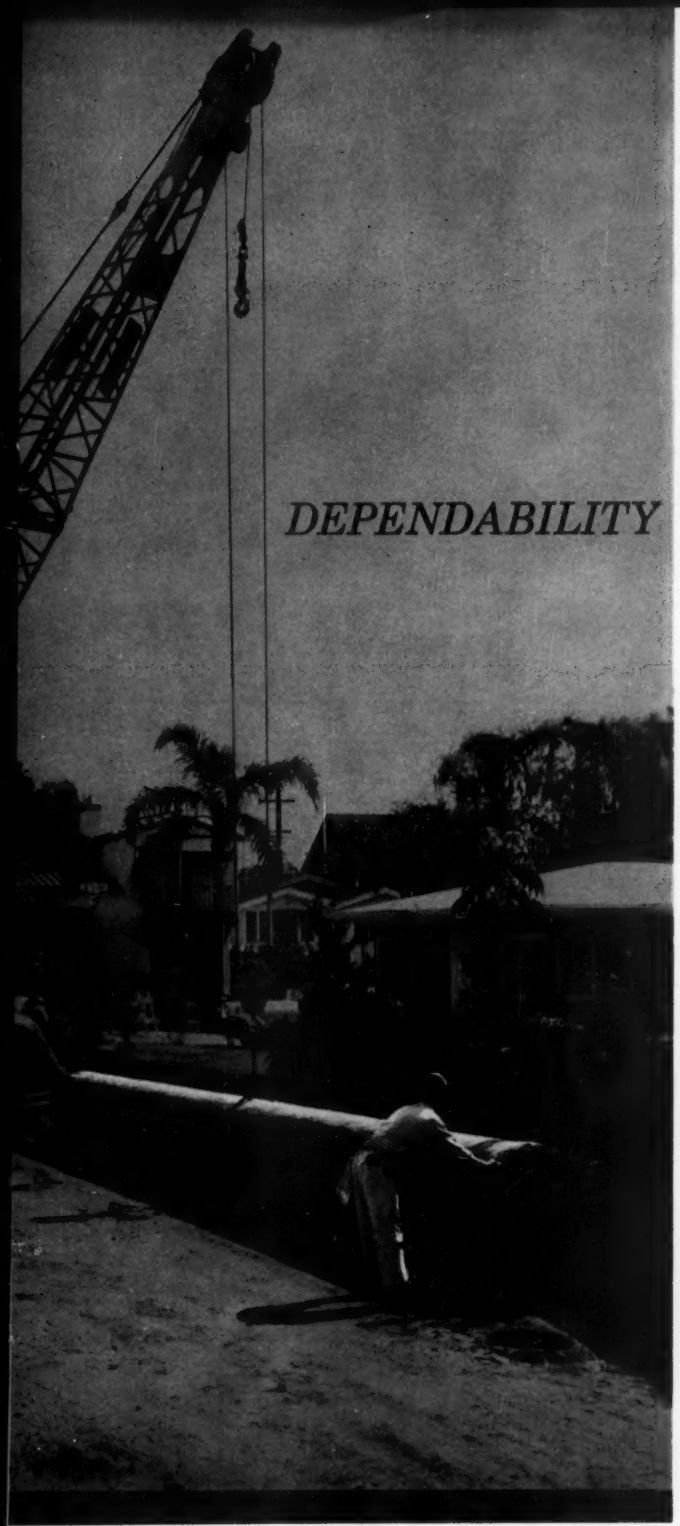


New $6,400,000 pier in the Fulton terminal area of Brooklyn, which was dedicated on July 1, is shown here in aerial view. The huge two-berth pier is the fifth of ten installations to be completed under the Port of New York Authority's $85,00,000 redevelopment program for the Brooklyn water front. It provides 176,900 sq ft of covered space and offers every modern facility for speedy loading and unloading of cargo and ship turnaround. The pier has been leased to Flota Mercante Grancolombiana, one of the largest carriers of import coffee in the Port of New York and co-hosts with the Port Authority in the opening-day ceremonies.

Steel Shipments at New High in May

Shipments of finished steel products from mills were at a new high in May, the American Iron and Steel Institute reports. The total of 8,754,119 net tons was about 150,000 tons above the previous record set in April and almost double May 1958 shipments of 4,649,499 net tons. At a new high were shipments of all types of bars and tool steel, pipe and tubing, line pipe, and drawn wire.

The major markets this May were the automotive, which took 1,736,994 net tons; warehouses and distributors, with 1,637,173 net tons; and construction (including maintenance), with 1,184,728 tons. The shipments for construction were at a new high, exceeding the former monthly record (1,175,463 net tons) set during May 1957.



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DEPENDABILITY with ECONOMY

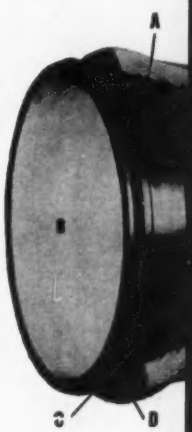
This pretensioned concrete cylinder pipe embodies all of the qualities and characteristics sought by water works engineers for permanent water supply and transmission lines—strength, sustained high carrying capacity; trouble free service and unusually long life. Its competitive initial cost has made it possible for hundreds of water works agencies throughout the West to obtain these desired qualities for pipelines with pressures generally ranging from 100 psi upward, and requiring diameters of 10″ through 60″ (or in many cases larger, where specific project conditions permit). When you select pressure pipe for your permanent water "growth lines," be sure to investigate American Concrete Cylinder Pipe, a superior product with an outstanding record of acceptance.

A. The steel cylinder provides a positive water seal or membrane as well as part of the total steel area required for internal stresses.

B. The smooth centrifugally applied mortar lining of a nominal ¾″ thickness provides positive internal protection, sustained hydraulic capacity, and, imparts rigidity and strength through "arching effect."

C. Steel reinforcement rods, which together with the steel cylinder provide the total cross-sectional steel area required for the operating pressure specified, are wound under controlled tension and accurate spacing around the concrete lined cylinder, placing it under moderate compression.

D. In conjunction with the steel rod reinforcement along the entire surface of the cylinder, the application of a dense concrete coating produces, in effect, a **reinforced jacket** which affords additional structural strength as well as positive exterior protection.



The 32-foot long pipe sections are easily installed with standard equipment using a single cable sling. In addition to providing a watertight seal, the rubber gasketed joint facilitates ease and economy of installation, and eliminates the need for caulking or field welding.

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EXAM GEMS

by

Reggie Strashn

R. ROBINSON ROWE, F. ASCE

EXAMGEM No. 1 had asked two questions—the depth of flow in a rectangular flume and the maximum-sized log which would float in it. The first was an academic cut-try chore, for which the answer and the problem data, as given last month, are summarized in Fig. 1. Both questions depend on Manning's

$$nQ = 1.486\, A\, R^{2/3}\, S^{1/2} \quad \ldots\ldots (1)$$

which the given data reduce to

$$AR^{2/3} = 23.78 \quad \ldots\ldots (2)$$

Mr. A, disarmed by the simplicity of the first question, looked at the second as an exercise in geometry. If the top of the log is .75r above the water surface, he deduced that

$$1.25r = d = 3.33$$

$$r = 2.66$$

Mr. B was a little sharper. Observing that a small log would drag on the invert but that a large one would scrape the banks, he found and rejected $r = 2.66$ and then derived from a little more advanced geometry

$$r(0.25) + \sqrt{2}\,) = d + 1 \quad \ldots\ldots (3)$$

$$r = 2.60$$

Mr. C also derived Eq. (3), but demurred at using $d = 3.33$. Since the log displaced water and the flow of water remained constant, the A in Eqs. (1) and (2) must be the section of the water,

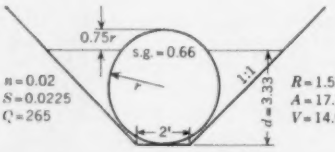


Fig. 1. The problem data and (at right) the solution to the first question.

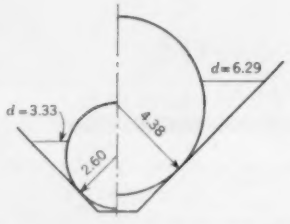


Fig. 2. Messrs. B and C agreed the log didn't touch the invert, but (not on its size).

$$A_w = d(d + 2) - .66\,\pi r^2 \quad \ldots\ldots (4)$$

However he used the gross area in computing R, the hydraulic radius, there being no friction between water and log moving together. Then, trying successive values for d in Eqs. (3) and (4), he satisfied Eq. (2) with $d = 6.29$ and $r = 4.38$, which didn't seem too large for a Yreka log. Fig. 2 compares it with Mr. B's.

Mr. D pondered a little longer over the "maximum-sized log" which "will float in the flume" and considered what would happen if a big log stranded and partially blocked the flume. Water would flow under the log, but if 265 cfs couldn't get under, water would back up in the flume and flow past the log on each side. At some stage of backwater, the flow would reach equilibrium when 265 cfs was flowing past the log in one closed and two open channels. If this stage reached the plimsoll mark of the log, it would float!

This was a man-size problem and Mr. D can be excused for making some convenient assumptions. Using Eqs. (2), (3) and (4), he computed R by combining the 3 channels into one with the same area and wetted perimeter.

$$P = 2 + 2d\sqrt{2} + r(\pi + 0.5) \quad \ldots\ldots (5)$$

which also assumed $n = 0.02$ for the log. Cut and try was then as easy as it was for Mr. C, but he floated a much bigger log with $r = 7.09$ when $d = 10.8$. It was a Bunyan-buster, more like Eureka than Yreka.

Who was right? Not Mr. A, of course, but each of the others earned a perfect score if he knew and told what his answer meant. Mr. B should say that only one log was mentioned and he interpreted "float" to mean "float steadily down the stream." Mr. C. should say that he interpreted "float" the same way, but realized 265 cfs was a lot of water for a log chute unless used for a continuous parade of logs. Mr. D should say that ripping or splitting logs in the woods is to be avoided at all costs, that the practical aspect of the problem was how big a log could be floated down the flume, regardless of whether it floated steadily or just bobbed along.

There's a moral, of course. Don't overlook engineering aspects of problems which may appear academic. Don't derive a numerical answer without stating exactly what it means.

EXAMGEN No. 2

Post mortems are the most interesting phases of registration examinations. Whether the groups are small or large, formal or informal, there will usually be an autopsy on the fairness and balance of the problems, with field men complaining "too much emphasis on design," and vice versa.

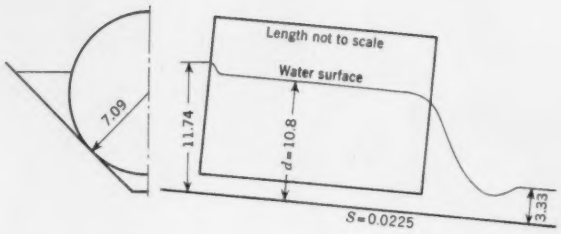


Fig. 3. Mr. D knew how to float a 14-ft log.

Field men had less cause for complaint last year in Oregon when a problem in logistics was offered optionally. It involves some principles applicable to force accounting in the field and estimating in the office, but you won't find them in books. Open books were allowed, but open eyes required. The text follows verbatim.

Construction materials must be trucked from a railroad siding over a single lane road through an area which will require passing turnouts. The road is 10 mi in length. The road must be widened at specific points where the trucks will meet and pass. Assume the average speed loaded or unloaded to be 10 mi per hr, and loading and unloading time to be 15 min with a single crew at each end of the road. Show all calculations.

(*a*) How many trucks can be efficiently operated?

(*b*) Locate the passing points.

(*c*) How many hr per day will loading and unloading crews be engaged?

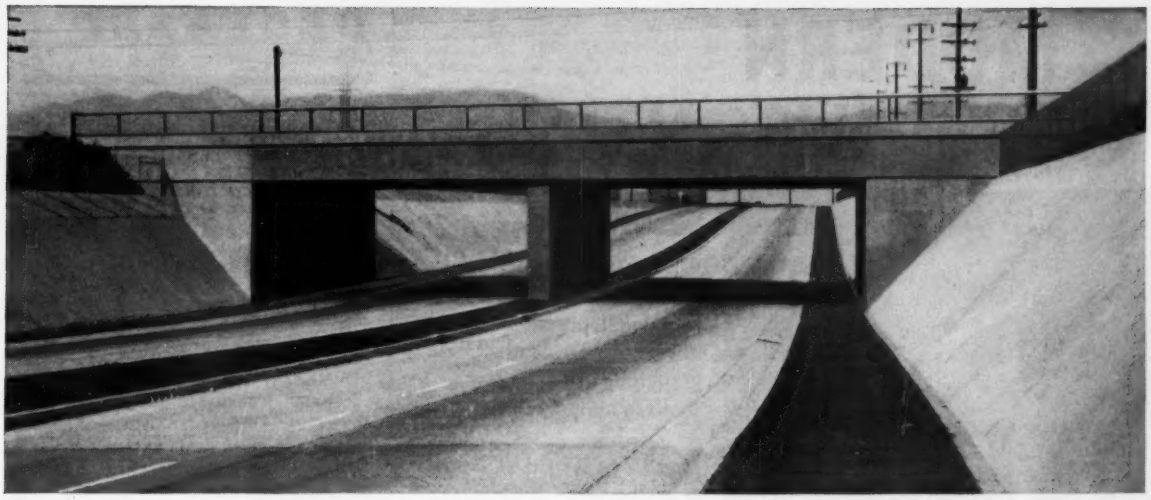
(Trucks are to operate as nearly 8 hr per day as possible.)

(*d*) When does the pay day begin and end for the loading crew, unloading crew, and the truck operators?

Gifts of Engineering Literature Requested

Engineers with more books than they can properly house may render a signal service to the new SEATO Graduate School of Engineering being established in Bangkok, Thailand, and at the same time straighten out their book shelves. The school is being established under the direction of the Colorado State University Research Foundation through a contract with the International Cooperation Administration. A comprehensive reference library to serve the staff and students is planned—initially in the field of civil engineering and later in electrical and mechanical engineering.

Anything in the way of good engineering literature—books, manuals, microfilms, special reports, and the like—is requested. Persons wishing to make such a contribution to the library should write to Dr. Maurice L. Albertson, Director, Colorado State University Research Foundation, Fort Collins, Colo.



Reinforced CONCRETE

Cored-slab, cast-in-place bridge deck
SAVES MATERIALS AND MONEY...

An interesting example of economical and practical bridge design is the new reinforced concrete bridge carrying five tracks of the Santa Fe Railroad over Paramount Boulevard in Los Angeles. The bridge is a two-span, cored-slab, rigid frame structure of reinforced concrete on pile foundations.

Los Angeles Highway Engineers have used this method of construction for many bridge structures. It has proved to be more economical not only because of the ready availability of materials but also because the cored slabs in the reinforced concrete bridge deck reduce dead weight in the completed structure.

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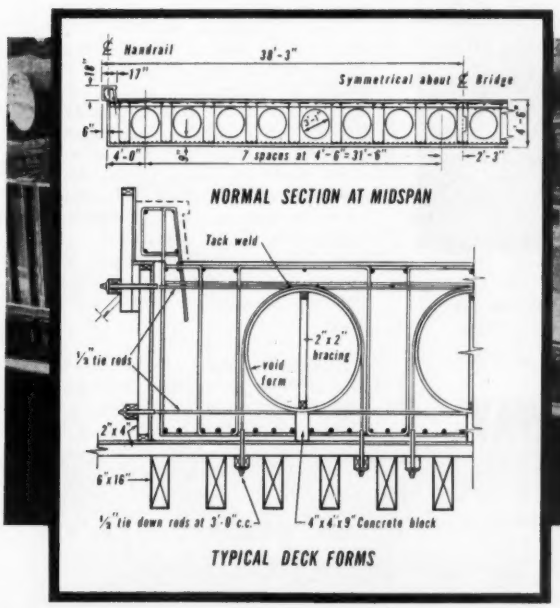
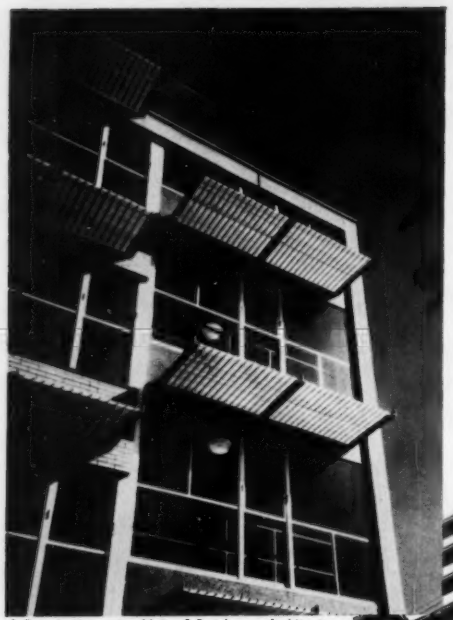


Construction detail of bridge deck forms, reinforcing bars, and void tie-downs.

Santa Fe Railroad Bridge over Paramount Boulevard, Los Angeles, California.
Designer: County of Los Angeles Road Department, Bridge Division.
Contractor: Otis B. Pierson Construction Company.

MODERN SUN CONTROL



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DECEASED

Barry R. Binstock (J.M. '57), age 26, of Forest Park, Ill., died here recently. Since graduating from the University of Illinois with a B.S. in civil engineering two years ago, Mr. Binstock had been a design engineer for the Chicago Bridge and Iron Company.

Edmund P. Burke (M. '44), age 71, manager of contracts with Buell and Company, architects, died recently in Denver, Colo. Prior to joining Buell and Company, he had directed the construction of the Ramo-Wooldridge Plant near Littleton, Colo. During World War II, Mr. Burke was chief engineer for the California Institute of Technology and for many years was a consulting engineer in Los Angeles and Pasadena, Calif. He attended St. John's College and took a special engineering course at Columbia University.

Clarence Winston Cooper (M. '45), age 71, consulting engineer of Dothan, Ala., died there recently. From 1947 to 1958, Mr. Cooper maintained offices in Montgomery, Ala., under the firm name of Winston Cooper Engineering Company. A civil engineering graduate of the Alabama Polytechnic Institute in 1908, he spent his entire professional life in Alabama, as president and general manager of the Alabama Structural Company in the late 1920's; as resident engineer with the Alabama State Highway Department in the mid 1930's; and for several years in the 1940's was engineer-in-charge of plans and specifications for the landing field at Brookley Air Base in Mobile and for the Dothan Airport in Dothan.

Welling Hall Craft (A.M. '47), age 60, for the past several years consulting engineer of Beaverton, Ore., died there recently. The first half of his career was as assistant resident engineer and resident engineer with the Bridge Section of the California Department of Public Works in Sacramento and as district superintendent of roads and bridges in Pierce County for the Washington Department of Highways. The latter half of his career was spent principally with the MacDonald Building Company, during which time he was field engineer for construction of the Army depot at Auburn, Wash., and chief engineer during construction of additional facilities at the Veterans Hospital at American Lake, Wash.

Howard H. George (M. '17), age 74, retired reclamation engineer with the Chicago Transit Authority, died recently in Chicago, Ill. A 1907 University of Pennsylvania graduate, Mr. George worked for the Public Service Railway Company of New Jersey from 1906 to 1928. Thereafter he was employed by the Cleveland Railway Company for five years, and for three years was assistant engineer with the U. S. Irrigation Service in the De-

(Continued on page 106)

Designed for today's concrete placement techniques

Uni-Form Panels have changed over the years to keep pace with modern concrete forming practice.

Today's Uni-Form Panels weigh a little more (about ½ lb. per foot) than other pre-fab form panels because *they are designed and built to meet today's requirements.*

We know that if the assembled concrete form is to have the structural rigidity necessary to withstand today's concrete placement techniques and high rates of pour, the individual panels which make up the form must have great inherent strength.

We produce the strongest form panel we know how to build. The great strength—and extra weight—of Uni-Form Panels is due almost entirely to the special "T" section steel frame which supports the struts or load bearing members of the panel.

Most specification concrete does not permit deflection in the forms. If the form panel does not have the strength to take the stresses imposed by normal concrete construction practices, it is a liability that can cause serious problems.

Uni-Form Panels are designed to take the full strength of the tie, plus a wide safety factor to avoid any possible deflection or permanent set in the load bearing member. Concrete formed with Uni-Form Panels will be straight and true.

Because they are so strong, you don't have to "baby" Uni-Form Panels. *You don't have to make major changes in your method of handling and placing concrete.* You can apply the heaviest practical pressures and highest pouring rates to a Uni-Formed concrete form with assurance that it will stand up and take it.

When you rent or buy any pre-fab form, it will pay you to consider carefully what you're getting. If you want a panel that is built to give you maximum forming speed, economy, efficiency, and service life—look to Uni-Forms. More contractors are using them every day because Uni-Forms deliver where it counts . . . on the job.

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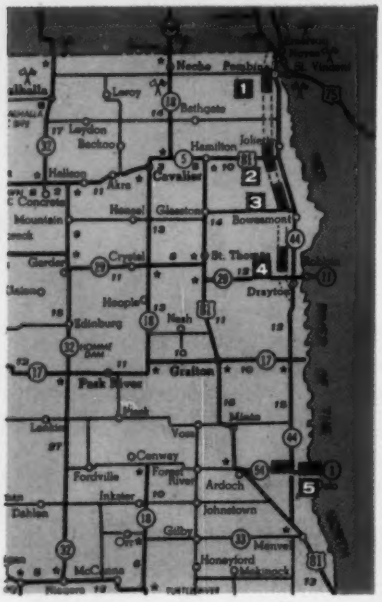
MAP showing locations of North Dakota's new Interstate Route 29 and State Route 54. Major bridges over the Pembina River at Pembina and over the Red River at Oslo, Minnesota, will be steel structures fabricated by the American Bridge Division of United States Steel. Others will be concrete on USS Steel H-Piles.



CONTRACTORS:

SITE 1: Swingen Construction Co., Grand Forks, N. D.

SITE 2: Otto J. Eickhof & Sons, Inc., Crookston, Minn.

SITE 3: Wm. Collins & Sons, Inc., Fargo, N. D.

SITE 4 & 5: Schultz & Lindsay Construction Co., Fargo, N. D.

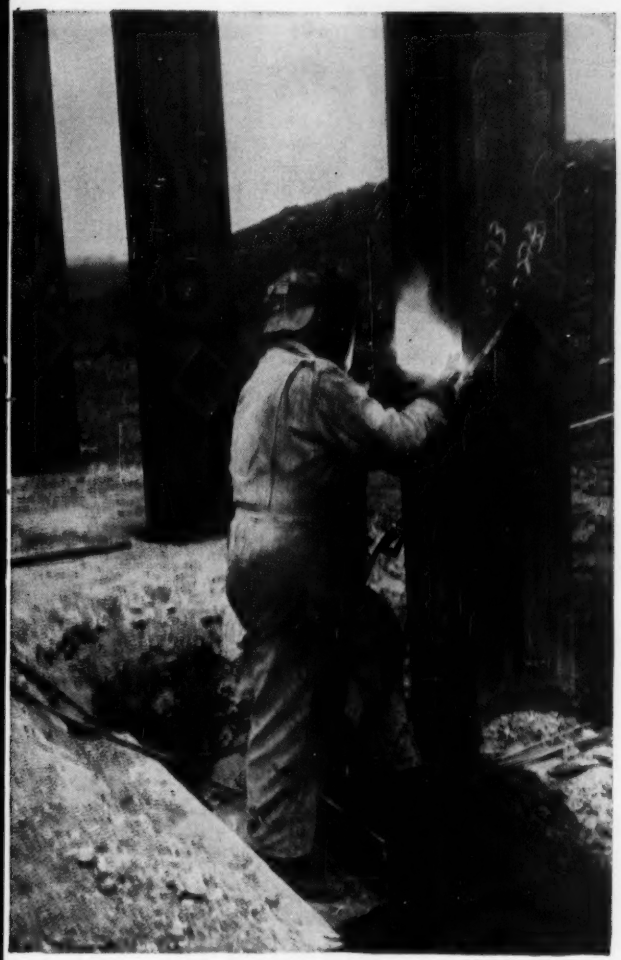
180 feet down. Welding plate on USS H-Pile which will be spliced to a pile already down. At this site, they drive piling 180 feet to reach firm footing.

USS Steel H-Piles pay off for North Dakota they now have stable foundations

North Dakota State Highway Department Bridge Engineers have been struggling with a baffling foundation problem for years. Recently, together with Minnesota Highway Department Bridge Engineers, steps were taken to find a solution. The valley area of the Red River which forms the northern portion of the boundary between these two states was once a lake but is now filled with a tremendous quantity of unstable clay to a depth of 180 feet or more.

Previously, bridges constructed in this area had been placed on displacement-type piles or on floating foundations. While neither of these methods was very satisfactory from the performance standpoint, there seemed to be no economical alternative. It was accepted as fact that periodic repairs would be necessary to correct for the deficiencies of these foundation supports. High maintenance costs appeared inevitable.

When the new Interstate Highway and other state projects were planned through the area, it was obvious that stable foundations would be needed for fourteen bridges involved. So in 1957, the North Dakota Highway Department in collaboration with the Minnesota Highway Department and the Bureau of Public Roads had test borings made in various locations. They found, at a level assumed to be the original lake bed, a mixture of gravel, clay and sand, which seemed dense enough to support piles in point bearing. Five test piles were driven and loaded. Test loads of 250 tons were successfully applied to 14", 73- and 89-pounds-per-foot USS Steel H-Piles. (Displacement piles had once been driven 80 feet into the overlying soil to attain a bearing value of only 12 tons per pile.) Working loads of as high as 90 tons per



Splicing two H-piles with diamond shaped plate. Ample strength is obtained.

Driving H-piles for the new Red River Bridge near Oslo, Minn. Previously, bridge foundations in this area were set on slabs or displacement piles.

and Minnesota . . . for 14 new bridges

89-pound pile were thus substantiated by these tests and subsequently incorporated into the final design. A total of 2,100 tons of USS Steel H-Piles were driven for these bridges.

The bridge engineers are well pleased with the results of this program. They saved additional money on the minor bridges by designing the intermediate piers to utilize piles encased in concrete as bents to support the bridge structure. They like the way the piles drive without damage, the easy splicing, and the assurance that their foundations will finally stay put.

Quick Deliveries. United States Steel is in excellent position to give you favorable deliveries on steel H-piles or steel sheet piling of any type. Write to any of our district offices or United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. *USS is a registered trademark*

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Many other churches stretched their construction dollars by using Vibroflotation. Recent church foundation work includes: In Florida—First Methodist Church, Hialeah; St. Patrick's Roman Catholic Church, Largo; Church of The Incarnation, Sarasota; Blessed Trinity Parish Church, Jacksonville; First Presbyterian Church, Coral Gables; New Provisional Church, Dunedin; and Catholic educational buildings at Pensacola, Orlando and St. Petersburg. In Pennsylvania—Parnassus Presbyterian Church, Parnassus.

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Deceased

(Continued from page 102)

partment of the Interior. Mr. George, who joined the Chicago Transit Authority in 1941 as surface lines reclamation engineer, had retired in 1956.

George H. Henderson (M. '24, F. '59), age 75, who retired April 1 as Rhode Island chief highway engineer, died on June 25 in Rhode Island. He had been the state's top highway engineer most of the time since 1924. His first employment period on the state roads occurred when he took a summer job while an engineering student at Brown University in 1908. He graduated in 1909 and went to work in an engineering job with the Metropolitan Park Commission and became a permanent employe of the old state board of roads shortly after. Recognized as a national authority on road pavements and design, Mr. Henderson had been honored before his retirement as Rhode Island's "Mr. Highways" and as dean of the nation's highway engineers.

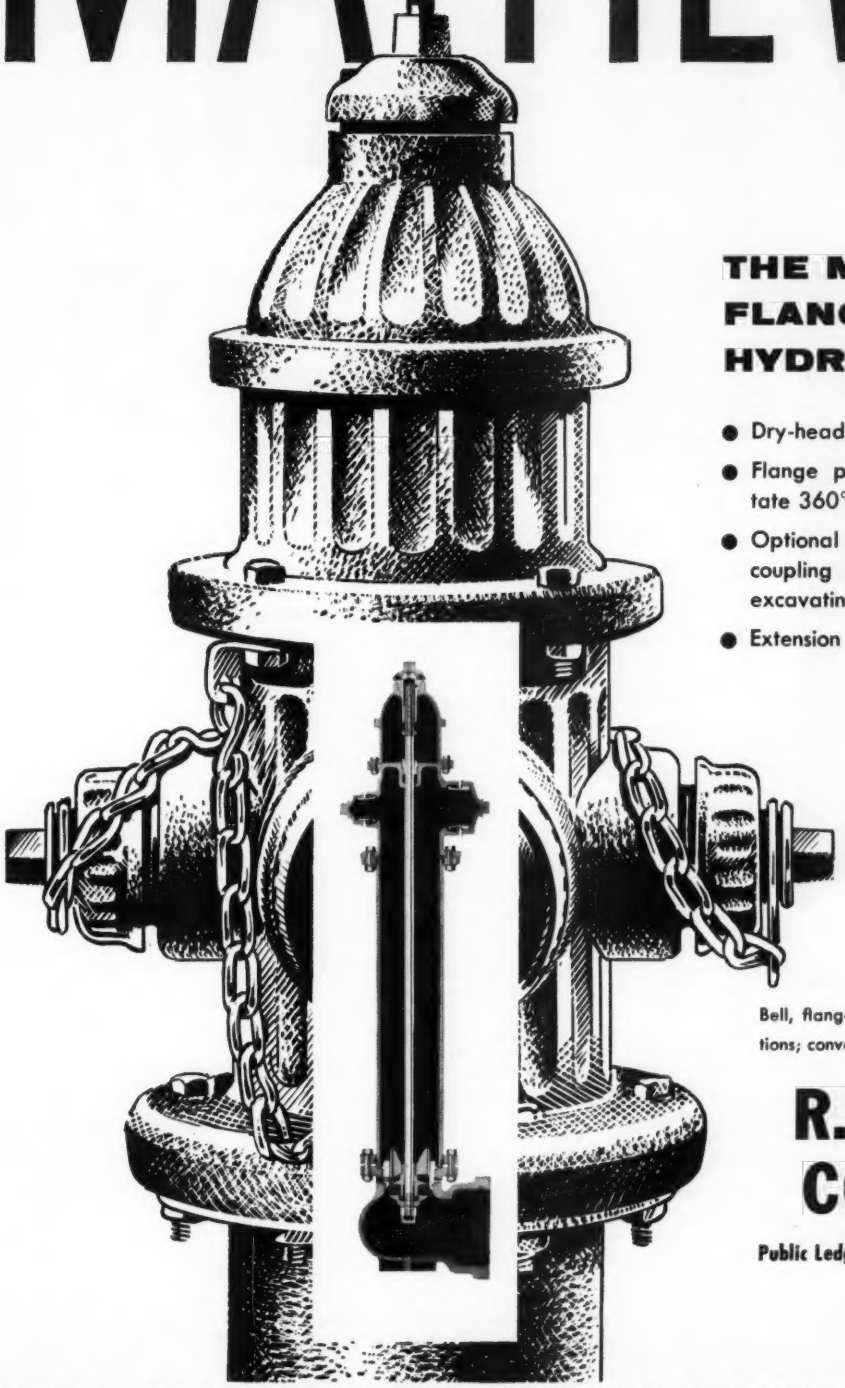
Charles H. Kernot (M. '27), age 74, deputy chief engineer of the State Electricity Commission of Victoria, Australia, died there recently. He had been a member of the State Electricity Commission since 1921 when he joined the Commission as a construction engineer. During this period he had charge of construction of Sugarloaf-Rubicon, a hydroelectric plant. In 1940 Mr. Kernot was named chief construction engineer and eleven years later, deputy chief engineer. Earlier, from 1912 to 1920, he had been executive engineer on the State Rivers & Water Supply Commission of Victoria in charge of construction and design of Sugarloaf Reservoir, including the 13,000,000 cu yd rockfill Eildon Dam.

Wesley E. King (M. '18), age 79, longtime president of Toltz, King, Duvall, Anderson & Associates, died in Minneapolis, Minn., on June 4. Mr. King graduated in 1905 from the University of Minnesota and in 1908 joined the Toltz Engineering Company. After World War II he became a partner in the firm, which was known as Toltz, King & Day until two years ago. During the thirty years he served as president, the firm did the Wold-Chamberlain Field, the Hamm, Pioneer and Athletic Club buildings, the Robert Street and Ford bridges, the Metropolitan and Midway stadiums, the dome section of the Cathedral and many schools in the St. Paul-Minneapolis area.

Sigmund Louis Levin (A.M. '51), age 42, civil engineer with Anchorage Engineering, of Studio City, Calif., died recently in Los Angeles. A 1947 graduate of the University of Arizona, Mr. Levin the same year joined the Los Angeles Flood Control District as a civil engineering assistant in the design division. Later he became engneering aid IV and civil engineer I in the hydraulic division. He joined Anchorage Engineering in 1956.

(Continued on page 108)

MATHEWS



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Deceased

(Continued from page 106)

William Aitken Miller (A.M. '19), age 73, died recently in North Sydney, Australia. Until his retirement several years ago, he had been a member of the civil engineering staff of the University of Sydney, his alma mater, since 1914; first, as a lecturer and then for three years as assistant professor, becoming a professor in 1927. Professor Miller had also received a civil engineering degree from the University of Glasgow.

Jerome A. Mullin (M. '46), age 68, consulting engineer and partner in the J. A. Mullin Company, Tenafly, N. J., died recently in Saddle River, N. J. Prior to opening his own offices, he worked for thirty-six years as draftsman, assistant engineer, and design engineer with the Raymond Concrete Pile Company.

Jerome Oscar Neuman (M. '50), age 51, senior structural design engineer with the L. P. Kooken Company of Baltimore, Md., died there recently. The year of his graduation (1930) from Johns Hopkins University, Mr. Neuman joined the Maryland State Road Commission as a bridge designer, remaining there for nine years. Thereafter, he joined the U. S. Corps of Engineers with headquarters in Baltimore as a designer of flood control structures, becoming a structural designer for war construction projects in 1942. Four years later he took over the postwar structural design section. In 1947 he left the Corps to join Saxe, Williar, & Robertson as head structural engineer, leaving there in 1950 to work for L. P. Kooken.

Wayne Perkins (M. '30) age 78, retired civil engineer, died in Sacramento, Calif., recently. Mr. Perkins graduated in 1904 from Dartmouth College and, from 1905 to 1919, served with the United States Bureau of Reclamation. While with the Bureau he helped draw up the preliminary plans for Roosevelt Dam in Arizona. In 1921, he moved to Sacramento where he served with the State Department of Water Resources until his retirement in 1949. Following his retirement he acted as consultant on dam construction and irrigation and municipal water supply distribution systems.

William A. Rathmann (M. '23), age 80, retired, of Buffalo, N. Y., died there recently. From 1916 to 1930 he served as assistant engineer in the Buffalo Department of Public Works and had charge of a survey division. He was Buffalo Commissioner of Public Works for several years and, more recently worked with the Buffalo firm of Nussbaumer, Clark, & Velzy.

Miguel Villa Rivera (M. '28), age 72, professor of structural engineering at the University of Havana, died recently in Havana, Cuba. Professor Rivera graduated from Rensselaer Polytechnic Institute in 1908 and did graduate work in 1909 at the University of Havana, after which time he joined the Department of Public Works' Bureau of Rivers and Harbors as assistant engineer. He remained with the Department for nearly fifteen years, becoming first engineer in the General Directors Office in 1922. A year later he joined the University of Havana as a professor.

Thomas Shedd, Former ASCE Director, Dies

Thomas C. Shedd (M. '26, F. '59), age 69, a consulting engineer and former professor of structural engineering at the University of Illinois, died in Urbana, Ill., on July 14. A graduate of Brown University in 1913, he received his master of science of civil engineering degree from the University of Illinois in 1933. Professor Shedd retired in 1958, having served on the teaching staff at the University of Illinois since 1925, to become an associate of the consulting engineering firm of Clark, Daily and Dietz, of Champaign-Urbana, Ill., Memphis, Tenn., and Carlyle, Ill. Professor Shedd served as Director of ASCE from 1954 to 1956.

Robert Merle Spoerlein (J.M. '49), age 32, died recently in California. The year of his graduation from Stanford University, Mr. Spoerlein became a junior civil engineer with the Power and Utilities Engineering Bureau for the city and county of San Francisco. At the time of his death he was assistant civil engineer with the San Francisco Water Department Laboratory.

Bertram Orlando Vannort (M. '39, F. '59), age 58, president of B. O. Vannort Engineers, Inc., died in Charlotte, N. C., on June 27. After gaining wide experience with engineering concerns, including Gibbs and Hill of New York, Mr. Vannort in 1939 engaged in private practice in Charlotte as a consulting engineer specializing in rural electric projects. At the outbreak of World War II he left Charlotte to become vice president of Gibbs and Hill, but returned in 1945 to re-establish his practice. Since then his firm has been concerned with an average of $10 million in construction work each year, including municipally-owned electrical systems and military electronic and radar systems. Mr. Vannort graduated from the University of Michigan.

Reinhold Bertram Wolff (A.M. '15), age 73, engineer inspector with the New York City Department of Water Supply, died in New York recently. At the outset of his career, Mr. Wolff was inspector with the New York City IRT Company and the New York Central. Later, he became chief engineer of the G. & B. Construction Corporation where he did extensive work on construction of new cell blocks, administration building and assembly hall for Sing Sing Prison at Ossning, N. Y. The major part of his professional life, however, was with the New York Department of Water Supply, where he spent a total of nearly thirty years in the Queens Borough Branch.

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Elementary Mathematical Programming

Intended as an intermediate approach, the subject is presented in relatively nonmathematical terms. Following a general treatment of the distribution, simplex, and approximation methods, the complete solution and analysis of two typical industrial problems is presented: a manufacturing and a blending problem. The applicability of high-speed computers for solving problems is then discussed, and available computer programs are indicated which will accomplish the solution of mathematical programming problems. The remainder of the book illustrates the details of various problems solved by programming. (By Robert W. Metzger. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 3, N. Y., 1958. 246 pp., bound. $5.95.)

Legal Aspects of Construction

A guide to "preventive law" which shows how to avoid legal entanglements and costly litigation in the areas of possible conflict of interest in the construction field. The rights and liabilities of the contractor, designer, owner, and financier are described and such topics are covered as licensing, mechanic's liens, insurance, labor and management, union contracts, workmen's compensation, compensable accidents, and arbitrations. The results of a number of adjudicated cases are also given in such areas as architectural practice, architect-owner relationships, owner's responsibilities, defective design and construction, general liabilities, and professional registration. A special section provides a thorough discussion of boundary problems. (By Walter C. Sadler. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y., 1959. 387 pp., bound. $8.50.)

Mathematics Dictionary

Substantially revised and enlarged, this edition contains more than 7,000 mathematical terms, concepts, and relationships ranging from elementary terms in arithmetic through calculus. In addition, multilingual indexes giving their Russian, German, French, and Spanish equivalents are provided. New basic terms have been added in the fields of modern algebra, number theory, topology, vector spaces, the theory of games, linear and dynamic programming, numerical analysis, and computing machines. Useful tables and an extensive list of mathematical symbols are given in the appendix. (Edited by Glenn James and Robert C. James. Multilingual Edition. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, N. J., 1959. 546 pp., bound. $15.00.)

Piles, Culees et Cintres des Ponts

This study of the piers, abutments, and arches of bridges begins with a short essay on the aesthetics of bridges. It then discusses piers and abutments and their resistance to various kinds of stress. A section on their erosion follows based on studies of the ruins of bridges. The main types of arches are then described and the book concludes with a study of the materials used in bridge construction including wood, concerete, and metals. (By J. R. Robinson. Dunod, Paris, France, 1958. 316 pp., bound. 3600 fr.)

Problems and Solutions

Volume II

A review of the material which is likely to be contained in parts 2 and 3 of the New York State Professional Engineering Examinations. Many of the problems usually asked in these examinations have their counterpart presented in this volume which covers the period from 1955 to 1958. Little attempt is made to answer descriptive problems, but rather to answer those problems which have a mathematical solution. (By Carlos E. Harrington. Published by the Author, 45 Elk Street, Springville, N. Y., 1959. 138 pp., paper. $2.75.)

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Symposium on Radioactivity in Industrial Water and Industrial Waste Water

Because of the advent of nuclear power, new problems have been created in the field of industrial water techniques. Papers are presented which discuss problems in the reactor plant itself and in the associated water waste. Methods of analysis are described which include those for radiation hazards. (Published as Special Technical Publication No. 235 by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1958. 69 pp., bound. $2.50.)

Symposium on Some Approaches to Durability in Structures

Papers dealing with nonmetallic materials that are generally used in structures where weather plays a major part in the durability of the structure. The problems of variations of kinds of exposure and of associated moisture migrations are discussed. (Published as Special Technical Publication No. 236 by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1958. 67 pp., $2.50.)

New in Education

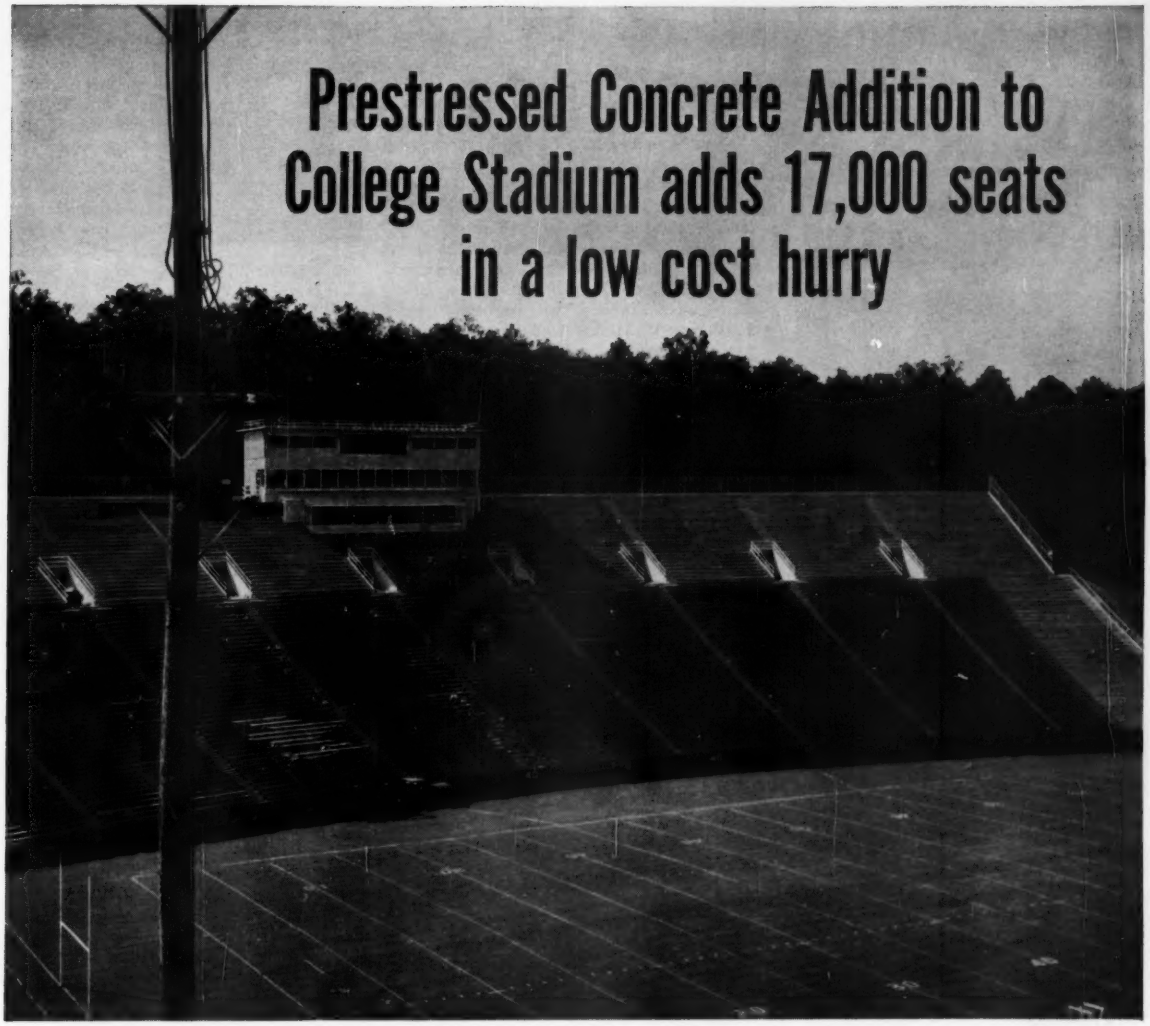
Building for research . . . *California Institute of Technology* has received $2½ million from the William M. Keck Foundation and the Superior Oil Company for the construction of a new engineering building. The new laboratories will provide the Institute with facilities for teaching and advanced reseach in the fields of materials testing, sanitary engineering, hydraulics and water resources.

Grants for education . . . *New York University's College of Engineering* has received a grant of $6,240 from the Atomic Energy Commission for use in its education and training program. The money will be spent for equipment to augment the subcritical nuclear reactor and the million-volt Van de Graaf "atom smasher" already installed. The new equipment will be used by students working towards the Master's degree in nuclear engineering.

For gifted high school students . . . The *Columbia University* School of Engineering's new Science Honors Program of college-level science courses for gifted high school students brings 158 outstanding 12-15-year-olds to the campus labs and classrooms on Saturday mornings. Beginning with a $29,000 grant from the Hebrew Technical Institute of New York, the program more than doubled its size with a subsequent grant from the Ford Foundation's Fund for the Advancement of Education. Competitive exams given to the students are showing remarkable results. Dr. Lloyd Motz, associate professor of astronomy at Columbia stated that "even the average high school student can go beyond what is expected . . . and grasp the most advanced theories of pure science," but "gifted students . . . are able to correlate them and often show new synthesis." Nominations of students must originate with school authorities. High schools listed their nominations during the spring for the 1959-1960 academic year. Professor John A. Hogman, of the School of Engineering, heads the Science Honors program committee. . . . Fourteen high school seniors from Dade County, Florida, have been awarded scholarships to take a special course in surveying at the *University of Miami*. Five professional engineering and contractor societies are financing them.

Fellowships . . . Applications will be accepted through October 5, 1959 by the *National Science Foundation* for fellowships under its Senior Postdoctoral and Science Faculty Fellowship programs. The Science Faculty Fellowships are directed toward teachers of science, mathematics, or engineering. Annual stipends to a maximum of $12,000—adjusted to match as closely as feasible the salaried income of the recipients—will be awarded under both of these programs. Applications may be obtained from the Fellowships Section of the Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D.C.

Prestressed Concrete Addition to College Stadium adds 17,000 seats in a low cost hurry



Five simple, speedy steps, via prestressed concrete, enlarged the Clemson College Stadium, Clemson, S. C. by some 17,000-plus seating capacity.

Designed by the engineering and architectural staff members of the college with an eye to economy and construction speed, the new structure was brought in handsomely on both counts.

From finished design to completed structure, five simple steps were involved:

1. Pour reinforced concrete frames in place and allow to cure.
2. Erect precast, pretensioned channel sections (fabricated at local casting bed with Roebling prestressed strand and delivered to job site by truck).
3. Weld preplaced plates in channel sections to preplaced plates in concrete frames (see photo at right).
4. Pour concrete steps on frames between channel sections.
5. Place wooden seats on channel sections.

The result is a no-maintenance, fireproof structure brought in at a cost that compares favorably with any other method to which the same requisites—low maintenance, fireproofness, construction speed and depreciation—were applied.

Welder joins channel sections to concrete frame. *Prestressed Fabricator:* Ballard-Rice Prestressed Concrete Co., Greenville, S. C. *Stress Relieved Strand* by John A. Roebling's Sons Corporation, Trenton 2, N. J.

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News of Members

(Continued from page 27)

Harvey F. Ludwig announces the opening of a San Francisco Bay area office and laboratory of the consulting and research engineering firm Engineering-Science, Inc., of which he is president. The new office at 4144 Telegraph Avenue, Oakland, will include facilities for engineering design and for laboratory research, development and analyses in the chemical, radiological and other scientific fields. A new Division of Water Resources Development will be headed by **Frederick L. Hotes,** who is completing an assignment as chief of the Water Conservation Division in Iran for the Development and Resources Corporation of New York City.

Albert J. Raman has been made a partner in the firm of Chas. H. Sells, Inc., with offices at Pleasantville (N.Y.), New York City, and Rochester. He was formerly project engineer for the New York firm of Andrews, Clark and Buckley.

Lloyd A. Dove, director of public works of the City of Ames, Iowa, has been appointed business manager of the E. C. Henningsen Construction Company, Inc., a leading asphalt contractor in Iowa. Before going to Ames, he was city manager of Nevada, Iowa.

Douglas E. Parsons was elected on June 23 to honorary membership in the American Society for Testing Materials during the society's 62nd annual meeting in Atlantic City, N. J. A member of ASTM for thirty-five years, Mr. Parsons holds its Award of Merit and is a former director. He is rounding out his thirteenth year as chief of the Building Technology Division of the National Bureau of Standards, Washington, D. C.

Gordon M. Fair, professor of sanitary engineering at Harvard University, recently delivered the Chadwick Lecture before the Health Congress of the Royal Society of Health at Harrogate, England. His paper on "New Factors in Man's Management of his Environment" dealt with three primary problems of the day in environmental health.

Trevor P. Craig has resigned from the staff of the Ohio State University, Department of Civil Engineering, to accept a position as soils and foundation engineer with G. K. Jewell and Associates, Soil and Foundation engineers, Columbus, Ohio. Mr. Craig recently filled a temporary assignment with the New York Department of Public Works at Latham, N. Y.

Bryce K. Tomlin, at present with the New Orleans (La.) firm of G. A. Heft and Company, has been appointed engineering consultant to "The Vibrant People," an economic and engineering group engaged in an on-the-spot study of the Latin American economy. Mr. Tomlin will leave the States within the next few months for the first leg of a thirty-month trip to South and Central America and the Caribbean Islands.

Donald D. Meisel was elected to the Board of Directors of Ambric Testing and Engineering Associates, Inc., at a recent meeting of the board, at which he was also appointed chief engineer. The firm is opening new testing laboratories at 4041 Ridge Avenue, Philadelphia.

John I. Parcel, Honorary Member of ASCE and director and vice president of the St. Louis firm of Sverdrup & Parcel, received an honorary doctor of engineering degree from his alma mater, the University of Illinois, on June 18. He was cited as a "distinguished former engineering educator, eminent structural engineer and consultant, outstanding author, and illustrious civil engineering graduate of the University of Illinois."

Frederick O. Diercks, Colonel, Corps of Engineers, has been assigned commanding officer, 159th Engineer Group (Construction), at Fort Bragg, N. C. As commanding officer of the Army Map Service in Washington, D. C., Col. Diercks directed the activities of one of the world's largest and most outstanding mapping agencies, involving an organization of 3,700 military and civilian personnel.

The firm of Fulton & Cramer, consulting engineers of Lincoln, Nebr., announces the retirement from active practice of **C. Robert Fulton,** consulting engineer since 1909, and the admission to partnership of **James D. Kissell.**

G. Brooks Earnest, president of Fenn College, has been elected president of the Cleveland Engineering Society. Professor Earnest has served ASCE as Director and Vice President.

Marshall McCord, for the past two years chief civil engineer of Green Associates, Inc., of Baltimore, Md., has been appointed chief engineer of the firm. From 1949 to 1956, Mr. McCord was project engineer for the J. E. Greiner Company, of Baltimore.

W. D. Bentley has been appointed industrial waste engineer for the Dallas (Tex.) Water Works, in which capacity he will be responsible for the administration of a newly adopted Industrial Waste Ordinance. For the past five years Mr. Bentley has been sanitary engineer and designer for the Dallas consulting firm of Forrest and Cotton.

James C. Tourek, chief project manager of the Vitro Engineering Company, New York City, has been made acting general manager. Mr. Tourek joined Vitro—a diversified industrial organization engaged in a variety of scientific and technological activities in the fields of nuclear energy, weapon systems, and extrative metallurgy—in 1950, after serving as construction superintendent with the Kellex Corporation, a Vitro predecessor.

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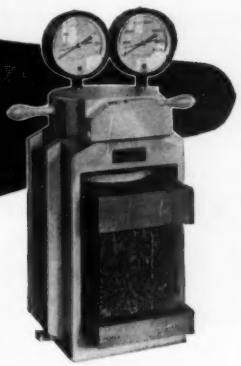

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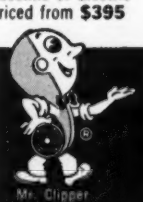

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Non-ASCE Meetings

American Institute of Chemical Engineers. Forty-first national meeting at the Hotel St. Paul, St. Paul, Minn., September 27-30. Address queries to Raymond C. Mayer & Associates, 51 East 42nd Street, New York 17, N. Y.

American Public Works Association. Annual congress and equipment show at the Seattle Civic Auditorium in Seattle, Wash., September 20-23. Requests for registration forms and additional information should be addressed to the American Public Works Association, 1313 East 60th Street, Chicago 37, Ill.

American Society of Mechanical Engineers—American Institute of Electrical Engineers. Seventh Engineering Management Conference at Statler-Hilton Hotel, Los Angeles, September 17-18.

National Power Conf. at Muehlebach Hotel, Kansas City, Mo., Sept. 28-Oct. 1.

Information about the conferences, hotels and advance registrations available from L. S. Dennegar, The American Society of Mechanical Engineers, 28 West 39th Street, New York 18, N. Y.

American Society for Testing Materials. Third Pacific Area National Meeting and Apparatus Exhibit at the Sheraton-Palace Hotel, San Francisco, Calif., October 11-16. For details write to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

American Welding Society. National fall meeting at the Sheraton-Cadillac Hotel, Detroit, Mich., September 28-October 1. Additional information may be had from American Welding Society, 33 West 39th Street, New York 18, N. Y.

Institute of Traffic Engineers. Twenty-ninth annual meeting at the Commodore Hotel, New York, N. Y., September 13-17. Further information is available from the Institute of Traffic Engineers, 2029 K Street N. W., Washington 6, D. C.

Maryland-Delaware Water & Sewage Association. Annual Water & Sewage Plant Operators Short Courses in sponsorship with the Chesapeake Section of the AWWA, Delaware State Board of Health, Maryland State Department of Health and the District of Columbia Health Department at the University of Maryland, College Park, Md., September 8-10. Requests for programs should be sent to the Maryland-Delaware Water & Sewage Association 2411 N. Charles Street, Baltimore 18, Md.

National Council of State Boards of Engineering Examiners. Thirty-eighth annual meeting at the Hotel Roanoke, Roanoke, Va., August 20-22. Advance registration cards and hotel reservation forms should be mailed promptly.

New York State County Highway Superintendents Association. Summer meeting at the Lake Placid Club, Lake Placid, N. Y., September 24-26. For further details write to the New York State County Highway Superintendents Association, Harry R. Mason, Office of the Secretary, Fonda, N. Y.

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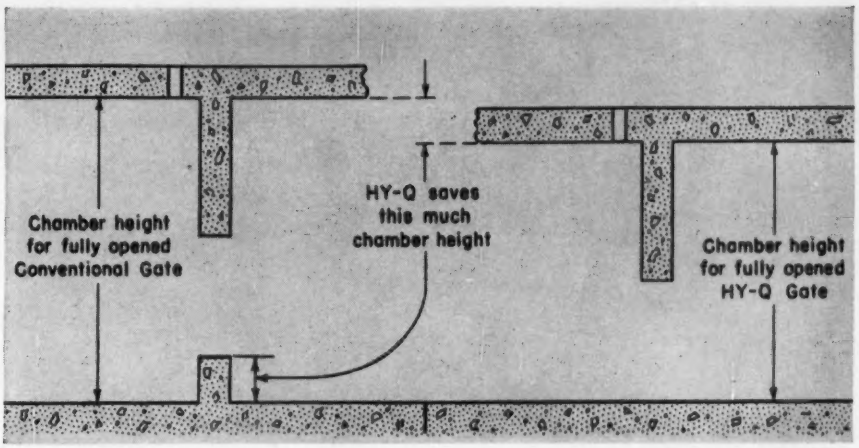
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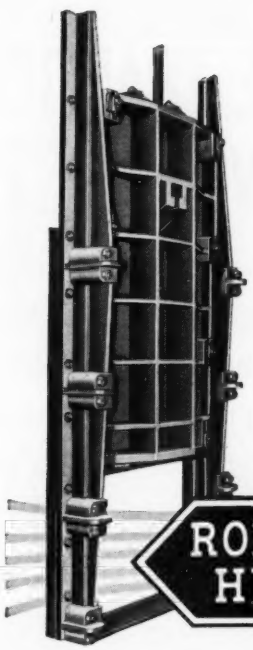

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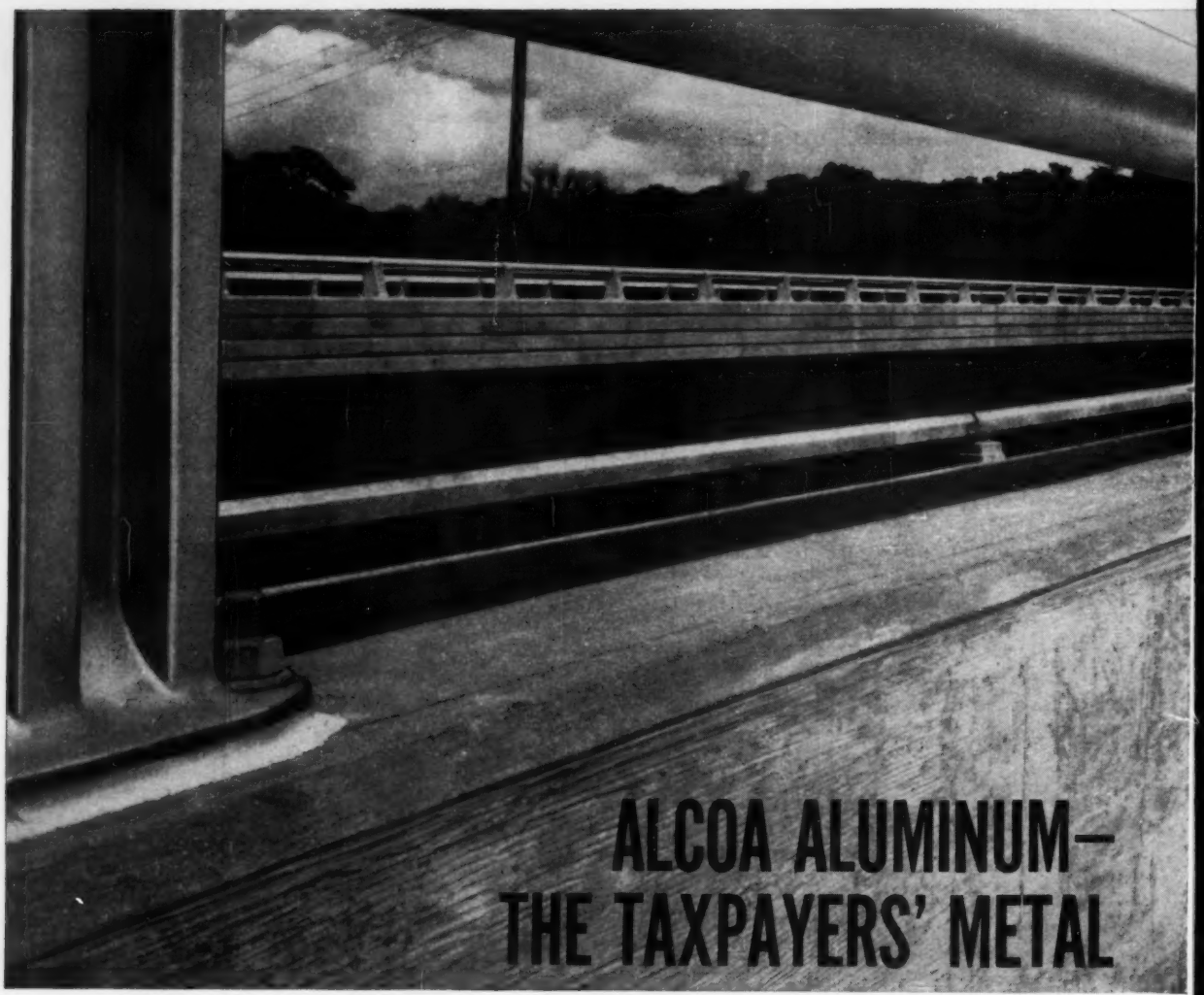

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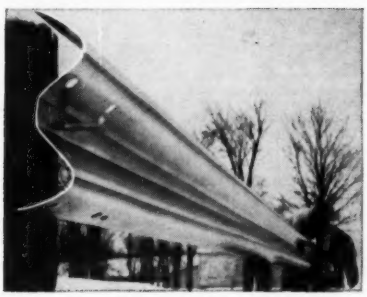
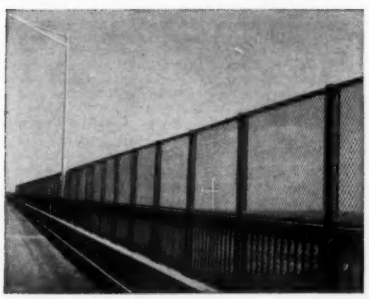
Alcoa® Aluminum is the taxpayers' metal. Light, strong and corrosion resistant, it makes highway dollars yield greater value in bridge railings, guard rail, lighting standards, fencing and highway signs. The reason is simple: first cost is last cost. Alcoa Aluminum's lightness assures faster, less expensive installation. Its defiance of moisture, road salts and corrosive fumes eliminates costly painting. Alcoa jobber-erectors and Alcoa's own technical experts can prove that you'll move more traffic at lower cost with highway products of Alcoa Aluminum. Your first step: write today to Aluminum Company of America, 1913-H Alcoa Building, Pittsburgh 19, Pennsylvania.



◀ **Alcoa Aluminum Beam Guard Rail** combines minimum upkeep with maximum protection. Impervious to the corrosive inroads of road salts, industrial fumes or air-borne grit, Alcoa Aluminum Beam Guard Rail never needs painting. An added safety factor is its increased energy-absorptive capacity gained from high-strength aluminum alloys. And Alcoa Aluminum Beam Guard Rail is available with aluminum posts, too, to round out the low-maintenance, high-safety story. Initial cost, only slightly higher than ordinary guard rail, is quickly saved.



◀ **Alcoa Aluminum Chain Link Fence** never needs painting. Here, again, first cost is last cost. Once Alcoa Aluminum Chain Link Fence is installed—on a highway as a divider strip or along a right of way, for instance—it never needs another penny's worth of maintenance. It is strong (minimum tensile strength: 54,000 psi), light and readily obtainable from Alcoa's nationwide network of jobber-erectors. It saves initial costs because installation is faster and easier, then keeps on saving money over the years because of its maintenance-free features.

▲ **Bridge Railings** of Alcoa Aluminum deliver maximum return for tax dollars, because first cost is last cost. It's a low first cost in the bargain, because lightweight aluminum is easier to handle and faster to erect. Corrosion-resistant Alcoa alloys never need maintenance; they end painting costs that commonly run to a dollar per lineal foot per year.

Your Guide to the Best in Aluminum Value

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These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 percent of the first year's salary if a non-member, or 4 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

Men Available

PROFESSOR, M. ASCE, Master's degree, age 36. Six years of teaching structural engineering, and ten years of industrial experience in bridge, building, and foundation design. Some recent publications. Desires teaching position. C-458.

STRUCTURAL ENGINEER, F. ASCE. Thirty years of experience in reinforced concrete design, especially raft and pilot foundations in Europe and America. Author of scientific publication in U.S. and Europe about modern design methods of foundation. Complete charge of projects. Location desired: East or West Coast. C-472.

CHIEF ENGINEER, M. ASCE, B.S.C.E., age 34. Twelve years broad experience in bridge and highway engineering including administration of all phases from inception of planning to completion of construction. Excellent record of accomplishment. Sound basic experience with major structural fabricator. Registered in Pennsylvania. Location desired: East or Middlewest. C-473.

SOILS ENGINEER, A.M. ASCE, B.S.C.E., B.S. Geology, age 28. One year parttime engineering college teaching; one and one half years on design and inspection of construction of rockfill dam and hydroelectric facilities; one and one-half years as field engineer in charge of drilling, soil testing and related investigations for $150 million hydro-highway smelter project in South America. Desires position in soil mechanics, foundations design or site investigations. Location desired: U.S. or abroad. C-474.

CIVIL, STRUCTURAL OR HYDRAULIC ENGINEER, M. ASCE, B.S. in C.E., M.S. in Hydraulic Engineer, age 39. Eight years of experience in pure and applied research in hydrology and hydraulics of surface and ground water and one and a half years of experience in steel and reinforced concrete structures of bridges and buildings. C-475.

ENGINEERING MANAGEMENT, M. ASCE, B.S.C.E., P.E. license—Texas and Louisiana, age 38. Sixteen years varied experience, military and oilfield construction, maintenance, design, planning, contract negotiation and supervision, economic studies and feasibility surveys, administration. Heavy marine experience, including offshore. Proven administrative ability, good organiser. Prefers project management, management surveys. Location desired: Southwestern U.S. C-476.

STRUCTURAL DESIGN—BRIDGES, HEAVY CONSTRUCTION, A.M. ASCE, M.S.C.E., age 36. Five and one-half years as senior designer for power intakes, power houses, tunnels and dams or for consultants, also bridges, specifications; one and one-half years designing falsework, cofferdams, estimates, heavy construction, structures and freeways; four months' designing school and commercial buildings and foundations for structural engineers. $775 per mo. Prefers San Francisco Bay area. S(M)-957.

OFFICE ENGINEER—CONSTRUCTION, A.M. ASCE, M.S.C.E., age 31. Ten months' expediting, scheduling, coordinating work, cost analysis, shop drawings for general contractors. Five years as planning engineer on water supply and irrigation for the government of Israel. Salary open. Prefers San Francisco Bay area. S(M)-897.

JUNIOR CONSTRUCTION ENGINEER—CIVIL WORKS, A.M. ASCE. C.E., age 24. Three years in charge of construction of military air base, facilities for the Navy. $6,000. Prefers Mid-West, West. S(M)-694.

PROJECT ENGINEER—CONSTRUCTION, R.M. ASCE, C.E., age 34. Seven years as structural designer, resident engineer, assistant project engineer on steam electric generating stations, hydroelectric plants for irrigation district, generating unit, auxiliary and water treatment, paper box plant for consulting engineers; two years as field superintendent on steel mill foundations for engineers-constructors. $10,000. S(M)-612.

SANITARY—INDUSTRY, GOVERNMENT, CONSULTANT, M. ASCE, C.E., age 48. For eight and one-half years did reports, estimates, studies on sewage, water supply for consultants, ten years as chief administrative officer with city public health service. $700-800 per mo. Prefers West Coast. S(M)-671.

DESIGN STRESS—STRUCTURAL AIRCRAFT, MILITARY, A.M. ASCE, C.E., age 27. Two years of experience doing stress analysis on jet rocket engines and aircraft; nine months on design, specifications, estimate and construction inspection for the military, two years as construction supervisor. (Army completed). $8,000. Prefers New York, San Francisco. S(M)-582.

STRUCTURAL DESIGN—CONSTRUCTION, ARCHITECTURAL, M. ASCE, C.E., age 48. Twenty and one-half years of experience designing oil refineries, process and industrial plants, marine installations, bridges, railroad and sewers for engineering constructors and municipalities; one year as field representative on atomic tests of structures for the government. $850 per mo. Prefers San Francisco, Northwest. S(M)-1869.

STRUCTURAL DESIGN—CONSULTANT, INDUSTRIAL, A.M. ASCE, M.S.C.E., age 27. Two years' designing prestressed, precast, concrete bridges for a consultant; three months' designing aircraft. $600 per mo. Prefers Northwest. S(M)-1578.

STRUCTURAL DESIGN—HYDRAULIC, INDUSTRIAL, CHEMICAL, M. ASCE, C. E., age 34. Six and one-half years' designing, checking, detailing, constructing and developing, water district, fabricating shop, chlorine plant; engineer-constructor for consultants on chemical plant. Salary open. Any location. S(M)-656.

DESIGN—CONSTRUCTION, PUBLIC WORKS, A.M. ASCE, C.E., California Civil Engineer License, age 33. Three and one-half years as department head engaged on construction plans, specifications, estimates on street, sewer, water systems, drainage, and flood control for consultant; three years as director of public works, engaged in city planning, designing and maintenance; three years as junior civil engineer on city public works. $10,000. Prefers Europe, Australia. S(M)-512.

OFFICE, FIELD—HEAVY INDUSTRIAL CONSTRUCTION, M. ASCE, C.E., age 43. Eight and one-half years as project engineer, cost engineer, office and field supervisor and contract liaison with responsibility for progress payments, estimates, reports on heavy industrial construction for construction company. $800 per mo. Prefers San Francisco area. S(M)-509.

ESTIMATOR, DESIGN—CITY, GENERAL CONSTRUCTION, A.M. ASCE, C.E., age 26. Two and one-half years as engineer-estimator on estimates, take-off quantities, coordinate subcontracts, purchase materials with a general construction firm, eight months as assistant field superintendent laying out utility lines, coordinating construction; ten months as estimator on take-off quantities, pricing, plumbing, heating and ventilation. $550 per mo. Prefers San Francisco area. S(M)-492.

DESIGN, ESTIMATE, SALES—PUBLIC WORKS, MANUFACTURING, CONSULTANT, M. ASCE, C.E., California License, age 39. Six years on estimates, contracts, sales, supervising office and field, steel erection, precast concrete, machinery, earthwork, flood control, and dams for a crane and rigging company, government and engineering construction firm. Two years as irrigation district manager. $7,800. Prefers San Francisco area. S(M)-488.

CONSTRUCTION ENGINEER, DESIGN—BRIDGES, PUBLIC WORKS, M. ASCE, M.S.C.E., California License, age 54. Twenty-five years as associate bridge engineer, supervising construction, designing of bridges, storm drains, facilities for the government. Six months drafting, designing highway structures for engineer-architect. Salary open. Any location. S(M)-446.

SENIOR PROJECT, CONSULTANT—WATER PROJECTS, M. ASCE, C.E., California License (and 8 others) age 56. Nine and one-half years as vice president on water development for consulting engineers. One and one-half years in private practice specializing in water development. Twenty-one years as senior engineer with the government on water supplies and use, civil works. $15,000. Prefers Northern California. S(M)-420.

GENERAL ENGINEERING, M. ASCE, B.S. in C.E., registered P.E.—California, certificate in Naval Architecture. Age 40. One year soils and concrete; two years' structural design; six years' engineering duty U. S. Navy; two years' municipal engineering; five years' Latin American experience as project engineer and over-water foundations engineer. Experienced in planning, inspection, design and administration. Speaks fluent Spanish, some Swedish and Portuguese. Location desired, foreign—Latin America or Europe. C-477.

FIELD ENGINEER, M. ASCE, B.C.E., age 25. Field and office—three years' assisting in supervision of construction of heavily reinforced concrete structures. Reviewed and supervised the review of contracts, plans, and specifications, for roads, walks, foundations, airfield pavements, drainage and flood control structures. Location desired, Greater Metropolitan area. C-478.

ENGINEERS

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Hydraulic

Structural

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GS-7, $5430 per annum
GS-9, $6285 per annum
GS-11, $7510 per annum

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Positions Available

PROFESSOR, civil engineering department, to head up structural division teaching and supervising undergraduate and graduate programs. Excellent opportunities in an expanding graduate and research program. Top salary and rank appropriate to qualifications. Ph.D. preferred. Position available in September or February. Location, Midwest. W-7515.

HYDRAULIC ENGINEER, degree in civil engineering, with a minimum of five years' experience in hydrological engineering, to conduct surface water studies. Location, South. W-7535.

CITY ENGINEER, registered engineer with experience in municipal engineering and with city planning commissions for fast-growing city of 30,000. Salary commensurate with qualifications. Location, South. W-7557.

ASSISTANT PROJECT ENGINEER, field and office, civil graduate, for heavy construction work. Must be interested in advancing to a job in a field supervisory capacity. Present assignment, upstate New York for 18 months. W-7560.

CONSTRUCTION EXECUTIVE, construction operations, with thorough knowledge of construction procedures, costs, labor production, and construction personnel, both subcontractors and company employees. Will be responsible for setting up, directing and coordinating field activities of subcontractors and company employees. Contracts include custom homes, stores, supermarkets, industrial buildings. Salary open. Location, central New England. W-7600.

BUILDING CONSTRUCTION ENGINEER, with estimating, office engineering and resident engineer experience covering alterations and additions of commercial structures, stores, shopping centers, etc. Must know all trades. Salary, $8,000-$10,000 a year. Location, mostly up-state New York. Headquarters, New York, N. Y. W-7603.

DIRECTOR (trainee) for school of civil engineering, with a minimum of two years' work experience in the field of civil engineering. Writing or teaching experience desirable. Will be required to learn the direction of instructional services and the preparation of instructional materials. Salary while training, $6,000-$6,500 a year. Location, East. W-7633.

HIGHWAY ENGINEERS, graduate civil. (*a*) Highway research engineer to work on research studies involving highway traffic. Will be responsible for the engineering, mathematical and statistical principles involved in segments of a large complicated study. (*b*) Supervisory highway research engineer to engage in the study of the structural action of highway pavements to develop basic knowledge that will aid in the establishment of rational methods of design. Salaries: (a) $7,510 a year; (*b*) $8,810 a year. Placement fees paid. Location, East. W-7639.

STRUCTURAL ENGINEER with three to five years' experience in construction design of industrial process buildings including both steel and concrete work. Should be familiar with structural problems on tanks, pressure vessels and equipment supports and should be interested in expanding scope of knowledge to include all phases of chemical industrial engineering design. Salary open. Location, Midwest. W-7645(*a*).

STRUCTURAL ENGINEER, preferably a graduate degree with specialization in structural engineering. Several years' experience along structural lines. Will be responsible for design and construction of equipment, buildings and structures. Should have management potential. Salary, to start, to $10,000 a year. Location, Midwest. W-7654.

ASSISTANT MAINTENANCE ENGINEER, civil or mechanical graduate, with industrial building maintenance experience. Salary, $8,000-$10,000 a year. Location, eastern Pennsylvania. W-7672.

CIVIL OR STRUCTURAL ENGINEER, graduate, licensed, for structural design, estimating and supervision of construction field work for prestressed manufacturing plant. Salary, $5,500-$9,000 a year. Location, South. W-7674.

RESIDENT ENGINEERS with at least five years of commercial building and alteration experience, to supervise projects, be responsible for costs, changes and prepare reports. Salary, $8,500-$9,500 a year. Locations: Massachusetts, California, Ontario, Canada. W-7675.

STRUCTURAL ENGINEER with pleasing personality plus structural design or construction experience for promotional and client contact in eastern U. S. Prior client contact experience not required though desirable. Salary open. Headquarters, Pennsylvania. W-7676.

ENGINEERS. (*a*) Resident engineer for water well drilling program. Must be experienced in geohydrology and in supervising water well drilling programs. Will be in charge of small central office and two or three water well drilling rigs and crews in the field. Salary, $19,200 a year. (*b*) Water well drilling superintendents, experienced in supervising water well drilling with all current types of rotary and precussion rigs. Knowledge of Johnson natural gravel pack system required. Salary, $15,000 a year. 18 month contracts. Company pays transportation for employees. Location, Near East. F-7679.

ENGINEERS. (*a*) Geohydrologists, experienced in water well drilling operations to analyze well cuttings, advise on drilling operations and write reports. Salary, $15,000 a year. (*b*) Office engineer, civil engineering or geohydrologist with administrative experience for duties in small central office for water well drilling program. Must be experienced in water well drilling operations and be able to write reports. Salary, $15,000 a year. 18 month contracts. Company pays transportation for employees. Location, Near East. F-7680.

TEACHING PERSONNEL, civil engineer, to teach in State College: surveying and topographical drafting program. Salary, $5,500-$6,000 for 9½ month school year. Location, Michigan. C-7547.

FIELD INSPECTOR—CONSTRUCTION, general contracting background required with minimum of five years experience, related to construction activity and qualifying for inspection of construction progress on residential, apartments and light commercial type construction. Able to read blueprints, understand specifications on whole building projects for contractor's servicing activity. Fresno to Lodi area. Substantial amount of driving. Car required. $400-450 per mo. plus profit and 7¢ per mile for car. Any age: Headquarters in Oakland, Calif. S(P)-4499

HEAVY EQUIPMENT DEMONSTRATOR—CONSTRUCTION EQUIPMENT, age 30-40. Should have broad experience in operation of many types of equipment and have some mechanical background and aptitude. Extended travel throughout Northern California, working with territorial salesmen in demonstration and sales of various types of equipment to all types of accounts. $500 per month, plus car and expenses. Northern California. S(P)-4497

DEALERS SALES MANAGER—CONSTRUCTION EQUIPMENT, age 30-40. Some experience in heavy hardware or light equipment sales, with emphasis on working with dealers. Position requires establishment of 20 to 25 dealers throughout Northern California, selling to them, working with their salesmen, checking inventory, etc. $500 per month, plus car and expenses, probable annual pay $10,000-12,000. Northern California. S(P)-4496

SALESMEN—CONSTRUCTION EQUIPMENT, age 30-40. (*a*) Prefer civil engineer or mechanical engineer, or equivalent experience, with local knowledge of contractor's equipment market and experience selling this type of merchandise. $500-600 month, plus car, and expenses, and 10 percent of gross profit. Metropolitan Sacramento. (*b*) Local experience selling contractors' equipment market. $500 per month, plus expenses, car, plus 10 percent of gross profit. Humboldt and Del Norte Counties. S(P)-4495

STRUCTURAL DESIGN—CONSULTANT, with good technical training and some experience on design drawings of steel and concrete frame structures. Must be able draftsman. Salary open. San Francisco. S(P)-4485

CONSTRUCTION SUPERINTENDENTS—SUBDIVISION, civil engineer graduate (or equivalent). (*a*) Superintend the placing of subdivision work, layout, surveys, follow through, construction of streets, sewers; public works. $880-1,070 per mo. (*b*) Assistant for (*a*). Prefer graduate civil engineer, with at least three to five years subdivision work. $600-810 per mo. San Francisco. S(P)-4476

JR. CIVIL ENGINEER—PUBLIC WORKS, recent graduate for starting position in Public Works Department. $450-550 per mo. San Francisco Bay Area. S(P)-4473(*a*)

PUBLIC WORKS INSPECTOR, some experience on streets and sewers. Requires U. S. citizen. About $500 per mo. San Francisco Bay Area. S(P)-4473(*b*)

CIVIL ENGINEERS. (*a*) DIRECTOR OF ENGINEERING-CONSULTANT, for new consulting office to be set up in New Mexico. Should be civil engineer. Salary open. (*b*) Sanitary engineer, experience in design of large sewage disposal and collection systems. Salary open. New Mexico. S(P)-4471

ASSOCIATE CIVIL ENGINEER—CONSULTANT, licensed civil engineer or land surveyor, young. To join established practicing engineer, with view to take over in year or two. Monterey County. S(P)-4470

STRUCTURAL ENGINEER—BUILDINGS, PUBLIC WORKS, civil engineer, California registration. Six years' experience in civil and/or structural engineering, including two years supervising in structural design, for responsible work preparing plans and specifications for school buildings, construction, etc. $797-992 per mo. Southern California. S(P)-4467

SALES—TRANSIT PIPE, civil engineer or sanitary, to age 35. Recent graduate trainee or more experience related to sales engineering of transit pipe and with experience or qualification to deal with architects, engineers, contractors, city, county and state agencies in development of substantial orders for transit pipe on water and sewage type applications; will consider previous design or field experience and sales aptitude. For district office of large manufacturer. To $5,800 for limited experience and to $9,000 for experience. Salary plus bonus arrangement and company car. San Francisco Bay area. S(P)-4464

CONSTRUCTION ENGINEER—BUILDINGS, prefer civil engineer with several years of experience in the field of land development and building construction to work as administrative engineer for development company. Review plans, deal with contractors before and after awards. Must be well adapted to work with people. Large company. $700-800 per mo. Some travel in San Mateo County. San Francisco Bay Area. S(P)-4461

SENIOR DESIGN ENGINEER—MINING, MILLING, civil engineer or mechanical engineer, age 25 to 45. Five years' structural and/or mechanical design experience. Some experience in construction work desirable. Perform duties as assigned by the chief construction engineer related to design of foundation for equipment, drawing of equipment modifications and supervision of field installation of equipment as indicated. (Would consider applicant with less experience at less salary). Reports to chief construction engineer. For uranium mining and milling co. $625-700 per mo. New Mexico. S(P)-4458

FIELD, OFFICE—WATER RESOURCES, graduate engineer from accredited school and two years' experience in civil or agricultural engineering including some experience in field of water supply development and utilization. $480-600 per mo. Northwest. S(P)-4442

CAREER OPPORTUNITY IN STRUCTURAL ENGINEERING TEACHING AND RESEARCH

Technological Institute in Midwest has staff opening for structural engineer with special interest in steel. Excellent facilities for both research and teaching, attractive salary range, liberal consulting privileges.

Man between 25–40 preferred, with doctorate

Send summary of experience and education to:

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Applications for Admission to ASCE, May 30—July 4, 1959

Applying for Member
(Under Old Designation)

KENNETH CLAIR ASPLANALP, San Francisco, Calif.
CHARLES BERNARD ABELMANN, Oakland, Calif.
RICHARD RICHARDS COULTER, Columbia, S. C.
GEORGE LEWIS FAIRMAN, Chicago, Ill.
WILLIAM FACK GOLDFIELD, Oklahoma City, Okla.
IRVING GOLDFIEN, Milwaukee, Wis.
RICHARD HULBERT GROVES, Alexandria, Va.
ALFRED WILHELM JOHNSON, Detroit, Mich.
HENRY ARNOLD KARO, Washington, D. C.
EDGAR HOWARD LANDGREN, Chicago, Ill.
JOHN EDWARD MACKEL, Los Angeles, Calif.
WILLIAM KELTY MAHER, Bethesda, Md.
DONALD A. OSTROWER, New York, N. Y.
ARTHUR FRANCIS PAGET, Victoria, B. C., Canada
ALFRED JOHN PERSONE, New York, N. Y.
WILLIAM FRED QUIRK, Indianapolis, Ind.
HARTLEY ROWE, Boston, Mass.
FRANK MICHAEL SWIFT, South Pasadena, Calif.
ELBERT RUPERT TAYLOR, Greenville, Ala.
PASTOR BORRES TENCHAVEZ, Manila, Philippines
MINORU TOGASAKI, Detroit, Mich.
ALVIN CHARLES WELLING, Washington, D. C.

Applying for Associate Member
(Under Old Designation)

CHARLES LEWIS ARMENTROUT, Hyattsville, Md.
JOHN DANIEL ATCHISON, Birmingham, Ala.
WILLIAM JOSEPH AUMEIER, Redwood City, Calif.
WILLIAM FRANCIS CLANCY, Milwaukee, Wis.
JEAN GEORGES PAUL DE GORCE, Gujrat District, West Pakistan
BERNARD EDWARD DONNELLY, Dallas, Tex.
EDDIE LEE DOUGHERTY, Kansas City, Mo.
TI HUANG, Ann Arbor, Mich.
JOHN MILVIN MCLAREN, Angleton, Tex.
FARREL T. MILES, Los Angeles, Calif.
GERRIT CORNELIS NIEUBORG, Amersfoort, Holland
JOHN TRACY OWENS, Wilmington, Del.
JOHN WALDEMAR STAKLE, Sanford, Fla.
NAZIH JAMIL TALEB, Beirut, Lebanon
VERNON BOYD TIPTON, Nagoya, Japan
JOHN BERESFORD TOPP, Fredericton, N. B., Canada
WALTER PATTERSON WEIGAND, JR., Baltimore, Md.
FREDERICK LEONARD WILLIAMS, Toronto, Ontario, Canada

Applying for Junior Member
(Under Old Designation)

JAYANTILAL SHAMJIBHAI ALAGIA, St. Louis, Mo.
FRANK ARANDA, JR., Artesia, Calif.
GEORGE MARTINSEN BARKER, Denver, Colo.
WENDELL EARL EVENSEN, Berkeley, Calif.
NAPOLEON FERRER GARCIA, Caracas, Venezuela
EHSAN UL HAQ, Cambridge, Mass.
THOMAS ROBERT IRWIN, Tujunga, Calif.
FRANK ANTHONY KOHLER, JR., University Park, Pa.
JOHN OVERTON LEWIS, Chicago, Ill.
KENNETH ALAN LUTTRELL, Sacramento, Calif.
BRIAN FENNELL MURPHY, London, England
AMBUR GURU MADHAVA RAO, Madhya Pradesh, India
RALPH PHILLIP SCHLENKER, New York, N. Y.
JOHN BASIL ZONDORAK, New York, N. Y.

Applying for Member
(New Designation)

WILLIAM EDWIN ANDREWS, Euclid, Ohio
LEO H. BARBOUR, Los Angeles, Calif.
MELVIN FRED BOYS, Indianapolis, Ind.
WARREN GEORGE CALLAWAY, Syracuse, N. Y.
THOMAS JOSEPH CASEY, New York, N. Y.
MICHAEL JOHN PAUL CASSELLY, London, England
JAMES CHAN, New York, N. Y.
TWING-KWAN CHEN, Kowloon, Hong Kong
EDWIN FRANCIS COFFIN, JR., Wellesley, Mass.
CLARENCE MCGEE CONWAY, Washington, D. C.
OLAV DANIELSON, Grand Island, N. Y.
FRANCIS CLARKE DAVIS, Mobile, Ala.
HENRY STEWART FELIX, Wilmington, Del.
OSWALD GRAATS, Johannesburg, South Africa
JON FAGAN HOAGLAND, Pryor, Okla.
LAVERNE SYLVESTER HORIHAN, Omaha, Nebr.
CLEMENT DIXON IVES, Honea Path, S. C.
JAMES DAVID KING, Phoenix, Ariz.
EUGENE RICHARD KUMMERLE, New York, N. Y.
SHAN SUN KUO, New Haven, Conn.
ROBERT JOHN LAUGHLIN, Seattle, Wash.
RAYMOND ANTHONY MACMATH, Trumbull, Conn.
LUIS FARIAS MARTINEZ, Guadalajara, Jal., Mexico
PAUL ERNEST MAST, New York, N. Y.
OLEG V. MIRAM, San Francisco, Calif.
PLACIE PEREIRA, Bombay State, India
LOWELL ARTHUR POWARS, Miami, Fla.
EARL MELFORD RALEY, Columbus, Ohio
JACK ANGEL SAFTICH, Milson's Point, N.S.W., Australia
EDWIN SIMON SCHMUCKER, JR., Vero Beach, Fla.
ROBERT ELLIS WATTS, Tehran, Iran

Applying for Associate Member
(New Designation)

ALBERTO BENITEZ, Chicago, Ill.
NOEL MILTON BENSON, Kansas City, Mo.
ELLIOTT RUSKIN BOWMAN, JR., New Orleans, La.
FRAND GABRIEL CASTELAZO, Glendale, Calif.
JAMES DONALD CRUTCHER, Lexington, Ky.
RALPH HOWE DUDLEY, Albuquerque, N. Mex.
NABI RASOOL FAKRODDIN, Springfield, Ill.
CLARENCE SHIGEYUKI FUJII, Honolulu, Hawaii
MARKUS GALLER, Montreal, P. Q., Canada
LUIS GARRIDO, Baton Rouge, La.
RAYMOND RACHMIM HASDAI HASSON, Salisbury, Rhodesia
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ROBERT LEE SCHUSTER, Lafayette, Ind.
ALDEN ANDERSON SCOTT, Atlantic, Ga.
SAMIR MOSTAFA SELIM, Salt Lake City, Utah
LYMAN RADLEY SQUIER, Urbana, Ill.
RICHARD BERTRAND TANNER, Sacramento, Calif.
YILDIRIM SELCUK ULKU, Chicago, Ill.
BRIEN BENJAMIN WALTERS, Klamath Falls, Ore.
RICHARD FORMAN WILLIAMS, Syracuse, N. Y.
YOCHANAN FELIX YOKEL, Manchester, Conn.

[Applications for the grade of Associate Member from ASCE Student Chapter Members are not listed.]

WALKER PROCESS PACKAGE PLANTS

UNIT DESIGNS FOR SMALL SEWAGE TREATMENT PLANTS
SIMPLE OPERATION — 90% automatic
ODOR FREE — no septic or stale operations
ADAPTABLE — concrete or steel tank construction

Details and preliminary plans are available to Consulting Engineers and their Architects, concerned with the design of small communities, subdivisions, institutions, schools, etc.

SPARJAIR Unit installed at a large Florida motel to handle 25,000 gpd combined sanitary and restaurant wastes. Note proximity of plant to motor court. Odor-free operation eliminates need of isolating plant.

SPARJAIR UNIT — Nested Contact Stabilization Plant — an easy to operate, low cost, small sewage treatment plant that is a model of simplicity. Designed on a new but proven principle, the contact stabilization process aerates and thoroughly oxidizes all odors in the sewage and overcomes previous objections to locating a plant near residences, shopping areas, schools, etc. Raw sewage settling tanks and septic digesters are eliminated. This plant utilizes a separate chamber for complete aerobic digestion (42% volatile remaining) of excess sludge.

Simple operation with minimum moving parts requires only part time attention. Capacities from 50 to 5000 population equivalent.

AEROBURN PLANTS — Package Aerobic Digestion; 24-hr. "Wet Burn" Aeration— designed for installations where economy is a prime factor and clarity of plant effluent is not vital. As with SPARJAIR units, the operation is odor free and practically automatic; with no delicate biological balances to achieve and hold.

Four standard sizes at 50, 100, 150 and 200 population equivalent.

SPARJPAC — Package Trickling Filter Plants — combines trickling filter and "wet burning" digestion in a two-story, compact design to provide best features of each type of treatment. SPARJPAC plants utilize DOWPAC® trickling filter media, developed by The Dow Chemical Company.

Design capacities range from 50 to 2500 population equivalent.

(DOWPAC is a registered trademark of The Dow Chemical Company).

WALKER PROCESS EQUIPMENT INC. factory • laboratories engineering offices AURORA, ILLINOIS

New Publications

Industrial zoning . . . . The seventh printing of "Principles of Industrial Zoning," aimed at improving zoning techniques and practices, is just off the press. The publication is the work of the National Industrial Zoning Committee, which is made up of committees of six organizations (including ASCE). Single copies sell for 25 cents each; on orders for ten or more the price is 10 cents a copy. Orders should be sent to the Secretary, National Industrial Zoning Committee, 820 Huntington Bank Building, Columbus 15, Ohio.

Prestressed concrete . . . . The Proceedings of the First and Second International Congresses on Prestressed Concrete—organized by the Federation Internationale de la Precontrainte—are now available and may be purchased from the Federation (Terminal House, Grosvenor Gardens, London S.W. 1). The proceedings of the First Congress, held in London in 1953, are priced at $10, and of the Second Congress, held in Amsterdam in 1955, at $15. The Proceedings of the Third Congress, held in Berlin in May 1958, will be available later.

Asphaltic concrete pavement . . . . Availability of a revision of "Principles of Asphaltic Concrete Pavement Design, Control and Construction" is announced by Oklahoma State University. Reissued as Engineering Experiment Station Publication No. 96, the brochure is intended to serve as a practical manual for engineers and for use in adult short courses for practicing engineers. The authors are Moreland Herrin, A.M. ASCE, and J. Rogers Martin, M. ASCE. Copies may be purchased from the Engineering Experiment Station, Oklahoma State University, Stillwater, Okla., for $1.00 each.

Safety in wastewater works . . . . The Federation of Sewage and Industrial Wastes Associations' most popular Manual of Practice, No. 1, has been revised and is now available under the new title, "Safety in Wastewater Works." The 64-page manual gives information on safe operation and maintenance of wastewater collection systems and treatment plants. Some suggestions for designers are also included. Copies sell for $1.50 (half price to Federation members). Orders should be sent to the Federation of Sewage and Industrial Wastes Associations, 4435 Wisconsin Avenue, N. W., Washington 16, D. C.

Air pollution . . . . Publication of a summary of the National Conference on Air Pollution, held in Washington last November, is announced by the Public Health Service. The 42-page booklet—entitled "Highlights of the National Conference on Air Pollution"—includes a digest of the six discussion sessions and a full report of the recommendations resulting from the sessions. Free single copies are available from the Air Pollution Control Program, Bureau of State Services, Public Health Services, Washington 25, D. C.

Concrete testing . . . . In "High-Pressure Test for Determining Air Content of Hardened Concrete," the Waterways Experiment Station reports a high-pressure test apparatus and method developed from a method originated by the Illinois Division of Highways, using 6 by 12-in. concrete cylinders. Copies of the report are 50 cents each, and may be obtained from the Director of the Waterways Experiment Station, Vicksburg, Miss.

Water resources, Canada . . . . The currently recorded water power resources of Canada, together with new capacity brought into operation in 1958, are reviewed in Bulletin No. 2641 of the Department of Northern Affairs and National Resources. Free copies are available from the Director, Water Resources Branch, Department of Northern Affairs and National Resources, Ottawa, Canada.

Building code . . . . Publication of the revised Code of Standard Practice for Buildings and Bridges is announced by the American Institute of Steel Construction, representing the structural steel fabricating industry. According to S. C. Herrick, chairman of the AISC Code Committee, "the revision establishes the limits of good practice applicable to the erection of single and multi-story steel-framed buildings." Free copies of the revised code may be obtained from the American Institute of Steel Construction, 101 Park Avenue, New York 17, N. Y.

SERVICISED "CEMENTONE"®

SPONGE RUBBER JOINT FILLER

★ Non-Extruding...High Recovery After Compression
★ Weather and Rot Resistant
★ Gray Color Blends With Concrete

"Cementone" is a High Density Material, Especially Designed for the Construction Industry

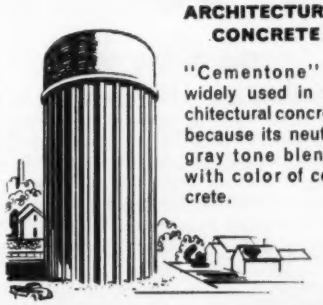
Servicised "Cementone" Sponge Rubber is a maximum performance joint filler, designed for applications where utmost resilience, non-extrusion, high recovery, material stability and resistance to the deteriorating effects of weather, mildew and rot are required. It is also widely used in exposed architectural concrete such as bridges and overpass structures, abutments, walls, etc. where its neutral gray color blends well with the color of concrete.

Because of its compressibility, high resilience and color, "Cementone" is ideally suited for use in tilt-up construction at vertical column and panel butt joints. (below)

Made from high quality blown sponge rubber, uniform in thickness and density, "Cementone" is available in cut strips or sheets in standard thicknesses of ¼", ⅜", ½", ¾" and 1" in lengths up to 10 ft. For greater thicknesses, "Cementone" may be laminated.

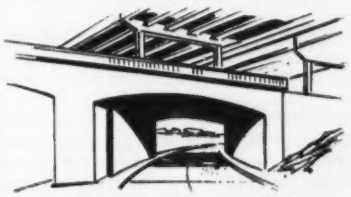
TYPICAL APPLICATIONS

ARCHITECTURAL CONCRETE



"Cementone" is widely used in architectural concrete because its neutral gray tone blends with color of concrete.

BRIDGE ABUTMENTS, STRUCTURES



Complete resilience and non-extruding qualities of "Cementone" Joint Filler make it ideal for bridge abutments, retaining walls, etc.

Write for the Servicised Catalog

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6051 WEST 65th STREET • CHICAGO 38, ILLINOIS

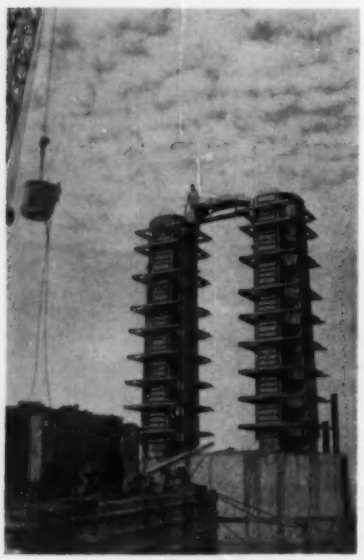
EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Steel Forms Used in Substructure Construction

MASSIVE CONCRETE PIERS, designed in cross section to facilitate single lift pouring and which eliminate construction joints, were constructed through use of specially designed steel forms in the erection of the substructure for the $22 million international bridge near Ogdensburg, N. Y.

The unusual feature of the forms used to construct the concrete piers was that they supported pours as high as 41 ft without external bracing or guys, and helped to minimize finish work. Heavy structural members, instead of tie rods, were used in the form design to resist concrete pressure in the unusually high single lifts.



No External Bracing

Column forms were capped as a unit over a 1-ft high stub, cast with the pier foundation, and positioned with leveling jacks. Concrete was placed at a rate of 1,000 cu ft per hour and cured 24 hours. Stripping and repositioning the column forms consumed only 8 hours. Bolts were loosened, the bond broken and the 20-ton unit was shifted to a barge. Bolts were retightened, structural members positioned, and the unit was ready for another column pour.

Support brackets for arch tie forms were fitted over a 5-ft thick stub cast with the pier column. The forms rested on screw jacks used for alignment and leveling. The single unit arch tie and two pier cap form sections were lifted in less than 3 hours. **Blaw-Knox Co., CE-8, 300 Sixth Ave., Pittsburgh, Pa.**

Compact Batching Plant

AN OUTSTANDING EXAMPLE of modern efficiency in concrete batching equipment and site layout is the new branch plant of Standard Concrete Co. at White Bear, Minnesota.

The 150-ton overhead aggregate bin, 500-barrel separate overhead cement storage silo, main batching section and supporting structures were factory preassemblies arriving ready for immediate erection.

A small concrete block building next to the supporting structure for the cement silo houses the electrical distribution equipment, air compressor, high pressure water tank and pump, oil circulating pump, water heater, condensation tank and toilet. Mixing tank for the ad-mixture and automatic dispensing units are housed in a small structure under the cement silo. An enclosed gasoline island for trucks contains air, water and grease facilities. Aggregates are fed by an inclined conveyor from a 175-cu yd, 4-compartment storage hopper. **Noble Company, CE-8, 1860 Seventh St., Oakland, Calif.**

Star Drilling Bits

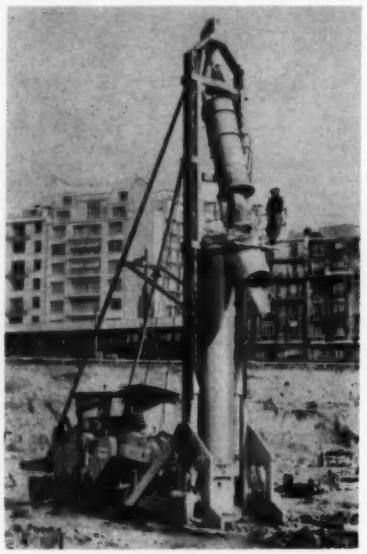
SPECIALLY-FABRICATED STAR drilling bits are being used in the sinking of caissons for the piers of a highway bridge over the Dong Nai river in South Viet Nam.

Each bit is designed with five cutting blades welded to a center mandrel and is dressed to gauge by applying hard surfacing material to the cutting edges. They will weigh approximately 4500 lb each. These bits will be used in placing 120 caissons, each having a 30-in. outside dia, anchored in basalt rock some 50 ft below the river bed. The equipment will penetrate some 20 to 25 ft of river sand and silt, and 15 ft of rock. **Spang & Co., CE-8, 143 Etna St., Butler, Pa.**

Caisson Excavating Machine

THE HAMMER GRAB, the digging tool used on the EDF 55 Boring Machine, can be fitted with different types of jaws—3 blades for rock, 2 blades hemispherical for soft soil. These jaws are available in 4 different diameters, all of which are adaptable on the same hammer grab, which operates within the casing. The machine can handle 4 different diameters—43¼ in., 39 in., 35 in. and 26¾ in. (o.d. at the cutting head on leading tube).

Alongside the development of the hammer grab, there was the problem of casing the hole when excavating through non-coherent strata. This is a most important feature of the Benoto system. The boring tube is held by a hydraulically clamped collar through

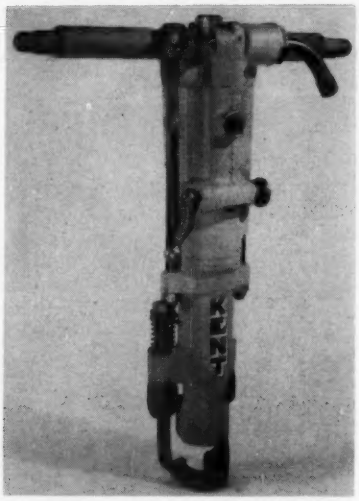


Can Handle Four Different Diameters

which a semi-rotary and vertical motion is transmitted to reduce skin friction between the tube and the ground, and during the formation of the pile between the tube and the concrete filling. The constant semi-rotary motion is achieved by the operation of two opposed hydraulic jacks acting horizontally on a boom attached to the clamping collar. Two other hydraulic rams operate vertically on the same collar to raise and lower the boring tube, forcing it into the ground when boring. In very soft ground conditions, the cutting edge can be maintained in advance of the level of excavation within the tube to insure the stability of the ground. **Benoto Inc., CE-8, 224 S. Michigan Ave., Chicago 4, Ill.**

Rock Drill

SAID TO OFFER GREATER durability and sell at a lower than average price, this Rock Drill, designated as the KS-48, is a light-medium drill with net weight of 50 lb. Having three speed operation and high penetrating power, the drill is



KS-48

reported to perform effectively for a wide range of work.

The KS-48 is made of heat treated steel parts and working parts are chrome plated. Interchangeability and availability of parts is stressed as one of the highly desirable features of all the company's tools. **Kent Air Tool Co., CE-8, Kent, Ohio.**

Heavy-Duty Shoring Equipment

THE MANUFACTURER STATES THAT Hi-Load shoring panels are engineered to carry working loads up to 20,000 lb per panel. This is twice the load capacity of conventional steel scaffold frames and for the first time, with this new equipment working loads may safely be carried on panel ledgers, as well as the panel legs. Because initial equipment costs are comparable with other types of shoring equipment, Hi-Load equipment cuts initial costs to almost one-half. As less equipment is needed, erection, stripping, handling and transportation costs are proportionately reduced.

In addition to heavy duty panels, Hi-Load equipment includes a complete line of shore heads, adjustment screws and accessory items, all designed to carry loads equal to the panel loads. This is one of the first systems specifically designed to handle all shoring jobs, regardless of height. **Waco Manufacturing Co., CE-8, 5251 W. 130th St., Cleveland, Ohio.**

Crawler Erecting Crane

CAPABLE OF HANDLING up to 300 ft of boom, a new 110-ton 1015 crawler erecting crane is being used to pour concrete in a multiple housing development in lower east Manhattan.

The crane which is equipped with a 1½-yd concrete bucket for this job, is owned by Castaldo Equipment Corp. and is being used by Knickerbocker Construction Co. to pour concrete for a total of four buildings of 22 floors each.

Each floor in each building requires 700 yards of concrete. The use of the high-capacity crane permits the pouring of one floor per day. It is expected that the same equipment will permit the use of the full 300-ft boom and a 1-yd concrete bucket to pour concrete on the top floors, at the same rate of pour.

Power for swing is transmitted electro-magnetically through P & H exclusive magnetorque. This swing assembly does away with the need for friction swing clutches, eliminates lining replacements, adjustments and maintenance required with conventional assemblies. It is said to produce faster work cycles, increased production and reduced operator fatigue. **Harnischfeger Corp., CE-8, 4400 W. National Blvd., Milwaukee 46, Wis.**

Portable Feeder Bin

DESIGNED TO HANDLE sand and coarse aggregates for hot mix asphalt plants, this new four-compartment portable bin has a storage capacity of 80 tons and will feed at the rate of up to 250 tons per hour.

Each of the two forward compartments, generally used for sand, have independent belt feeders which discharge on to the main conveyor belt. Coarse aggregates discharge on to the same belt through adjustable gates from the third and fourth bins. **Standard Steel Corp., CE-8, 5001 S. Boyle Ave., Los Angeles 58, Calif.**

PACKAGED WATERLINES

Lower costs! Eliminate worries!
One purchase order does it all!

NOW—A REVOLUTIONARY NEW LOW-COST CONCEPT IN PIPE BUYING

SOUTHERN PIPE PACKAGED WATERLINES offer you a brand new way to save money, cut red tape, eliminate worries. One order does it all—from pipe production, lining and coating, to trenchsite delivery. You buy one complete waterline package, delivered when you need it.

SOUTHERN PIPE PACKAGED WATERLINES GIVE YOU: (1) pipe produced to your exacting specifications, (2) from steel coil in our own pipe mill, (3) cut precisely with NO random lengths, (4) lined and coated at our plant, (5) warehoused, if necessary, until you need it, and (6) delivered to your trenchsite ready for placing in trench. *Packaged Waterlines* from our warehouse stock of standard sizes are also available for immediate delivery.

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USI Southern Pipe DIVISION OF U.S. INDUSTRIES, INC.

SP-24-59

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EQUIPMENT, MATERIALS and METHODS

(continued)

Trench Drill

A NEW SERIES OF trench drills capable of drilling 400 ft and pushing pipe as far as 250 ft has been introduced. The unit (Model 24-TD) is being used by contractors and utilities to install water, gas, electric and phone lines under streets, highways and railroads without cutting paving; it is also being used in dewatering jobs of all types.

The drill is powered by a 52-hp gasoline motor, and has 4-speed transmission; electric starting; forward thrust of 30,000 lb; and maximum torque at the auger of 6500 ft lb. The drill is equipped with variable hydraulic feed in a rigid frame for drilling accuracy. **The Salem Tool Co., CE-8, 700 S. Ellsworth St., Salem, Ohio**

Structural Shape Cutter

THE STRUCTURAL SHAPE CUTTER employs many engineering features which will greatly reduce handling, layout and cutting time on structural shapes such as I beams, H beams, angles, channels, bars and plates. Two independently operated variable-speed motors activate the horizontal and vertical geared tracks, insuring a smooth, steady cut.

Constant heat is achieved by solenoid valves which coordinate the gas and oxygen at the burning tip. Costly removal of burning slag, which is a problem with conventional burning, is reduced to a minimum by combining uniform speed and heat. A conveniently located adjustable dial can be set allowing smooth, mitered or straight cuts. **Steffan Mfg. Corp., CE-8, 1585 S. Lincoln Ave., Salem, Ohio.**

Live Power Steering

NOW ALL MODELS OF Caterpillar D8 Tractors (prior to 14A Models) may be equipped with Live Power Steering, making it no longer necessary for the tractor to be equipped with a steering clutch changeover.

Reducing operator fatigue and providing positive engagement or disengagement of the steering clutches, the attachment transfers complete clutch control to fingertip levers. It is a hydraulic system, consisting of a double hydraulic cylinder connecting to both steering clutch adjusting rods, a heavy-duty control valve, Vickers hydraulic pump, plus reservoir, hoses, brackets and hardware. **Rivinius, Inc., CE-8, Eureka, Ill.**

Giant Butterfly Valve

TO BE INSTALLED IN a vault 40 ft below ground level, this butterfly valve will control the flow of raw water, a million gallons every three minutes, in the Montebello Tunnel, Baltimore, Maryland.

With the help of cranes, derricks and 15-ft ladders and a specially constructed test head, the valve was tested for bubble-tightness, at 30 lb per sq in. design pressure and 45-psi shock pressure.

The 120-in. valve weighs 41,000 lb,

Weighs 41,000 Lb

and has a shaft of solid stainless steel 9 in. in dia and 15 ft long. Weighing 9,000 lb, its disc has a stainless steel seating edge which closes against a 1¼-in. thick rubber seat which weighs 450 lb and is held in place by stainless steel segments.

The specially constructed Phillie Gear valve operator develops a torque of 750,000 in. lb with a 40-ft lb input, permitting closure of the valve by one man in case of an emergency. **B-I-F Industries, Inc., CE-8, 345 Harris Ave., Providence, R. I.**

New Cleaners

NEW, LARGE CAPACITY EQUIPMENT for flushing and cleaning out the paint passages and hose lines in complex finishing equipment like automatic spray machines, paint heaters and multi-station systems has been developed.

Available in 2, 5, 10 sizes, the new units

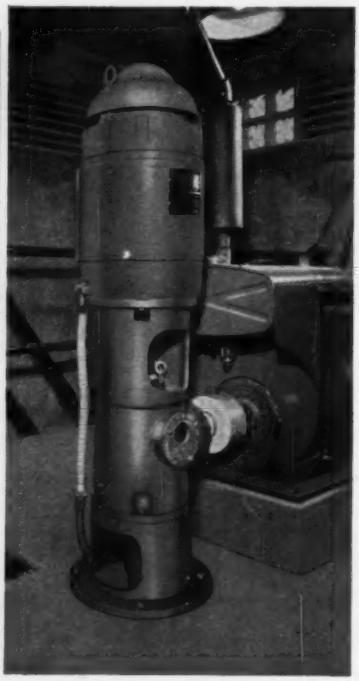
(Continued on page 125)

For positive protection against power failures, install

JOHNSON

Right angle

GEAR DRIVES



Cross State Development Co. installed the Johnson combination drive shown here in a sewage disposal plant in Florida. They report: "It's recognized as one of most efficient, packaged systems in the Tampa area. We've never experienced any difficulty." Neither will you because Johnson combination drive assures engine take-over the instant electricity fails. Either power unit may be overhauled without interrupting service.

Sizes: 15 to 450 hp. Johnson Right Angle Gear Drives are available in combination, dual and standard types; for all horizontal prime movers; hollow or solid shaft. Please write for engineering catalogs.

7-R

MEMBER OF AGMA

JOHNSON MAKERS OF FINE GEARS SINCE 1904

GEAR & MANUFACTURING CO., LTD.

8TH AND PARKER STREETS • BERKELEY 10, CALIFORNIA

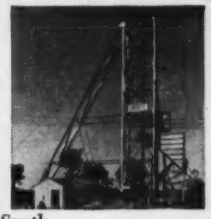
EQUIPMENT MATERIALS and METHODS

(continued)

consist of a pressure feed tank shell, lid assembly, safety valve, and a new triple action cleaner and air mixer assembly, which has two metering valves, one for air and one for the cleaning solution. By adjusting either or both valves, either all air, all cleaner, or a combination of both can be fed into the equipment to be cleaned. **The DeVilbiss Co., CE-8, 296 Phillips Ave., Toledo, Ohio.**

MAYO ALL-STEEL

SINKING FRAMES and HEAD FRAMES



Safe — Dependable — Designed right for the job. For your operation, depend on Mayo methods and skill based on over 25 years' experience in America, Europe and South America. Write for Bulletin No. 20A.

- Steel Forms
- Muck Bins
- Shields
- Air Locks
- Locomotives
- Mine Cars
- Grouters

MAYO

TUNNEL AND MINE EQUIPMENT
LANCASTER, PENNSYLVANIA

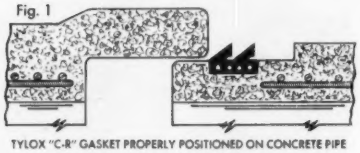
Rubber Gasket

A NEW RUBBER GASKET for recessed sewer pipe which cannot roll or twist out of position during pipe coupling operations has been produced.

"G-R" Tylox Gaskets are of the "Snap-on" type, designed for use with recessed tongue and groove or bell and spigot pipe of all sizes, and may be made of either rubber or neoprene. They can be applied to pipe either at the pipe manufacturer's plant or by the contractor at the job site.

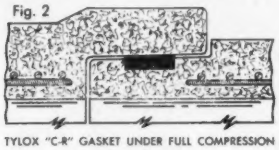
The gaskets consist of heavy base

Fig. 1



TYLOX "C-R" GASKET PROPERLY POSITIONED ON CONCRETE PIPE

Fig. 2



TYLOX "C-R" GASKET UNDER FULL COMPRESSION

bands of rubber having integrally formed, multiple sealing fins, and specially designed pressure pockets. As "G-R" Gasketed pipe is coupled, fins and base are compacted into a solid "pack" of rubber which seals the annular space by compression. The wide, flat design of the gasket, plus the support provided on both sides by the walls of the recess, prevent the gasket from being rolled or twisted out of proper position during pipe coupling operations. **Hamilton Kent Manufacturing Co., CE-8, 427 West Grant St., Kent, Ohio.**

Semi-Automatic Tongs

THE USE OF SEMI-AUTOMATIC TONGS saved approximately 150 hours time while pulling sheet steel piling after construction of the foundation for the Crown-Zellerbach Building, San Francisco.

Formerly the contractor burned four 3-in. holes in the top of each pile and inserted pins attached to a wire sling. In addition to taking time, this made it necessary to scrap one lineal foot of each pile. However, the tongs grip a pile firmly and pull it safely, with no need for boring holes or inserting hooks.

Intended for use with ½-in. thick piling, the tongs have a maximum jaw opening of 6 in. The leverage of the tongs is such that they get a tighter grip as the pull is increased. The jaws are shaped to present a maximum bearing surface. For additional pulling power, each jaw has 15 teeth that help grip the sheet steel firmly, but without damage. **Heppenstall Co., Materials Handling Div., CE-8, Fifth Ave. and 16th St., New Brighton, Pa.**

Reflective-Crested Fence Posts

READY-MADE REFLECTION FENCE POSTS, brightly visible at night in the headlight beams of automobiles, trucks or farm tractors, have been introduced.

The top few inches of the Crest Lite steel fence posts are reflectorized with "Codit" brand reflective liquid, which is silver-grey by day, and a brilliant silver in headlights by night.

After more than two years of extensive research and experiments, this premium mallard green crested post is offered at no additional cost as an aid to safety on farms, estates, parks, country lanes, and on modern highways. **The Pollak Steel Co., CE-8, Box 237, Cincinnati 15, Ohio.**

Mars Outstanding Design Contest

SQUARE WHEELING, A PATENTED invention by Albert Sfredda, of Bethlehem, Pa., has won him one of the $100 cash awards in the 1959 Mars Outstanding Design Contest.

The square shape gives superior traction in mud, sand, snow or on uneven terrain. The flat surfaces bridge the ruts instead of sinking in as do round wheels. The wheels can be in any relative position; they do not need to be synchronized; yet they run smoothly. They are designed for use on heavy trucks, jeeps, farm or construction machinery, and speeds up to 35 miles per hour can be attained. **J. S. Staedtler, Inc., CE-8, 25 Dicarolis Court, Hackensack, N. J.**

Paving Breaker

A POWERFUL PNEUMATIC TOOL ENGINEERED for heavy demolition of masonry, concrete, stone and asphalt surfaces has been announced.

Amazingly little recoil and low air con-

(Continued on page 126)

HANDLE THAT WET JOB PROFITABLY

MORETRENCH WELLPOINT SYSTEM

Results Guaranteed

Send for Catalog

MORETRENCH CORPORATION

World's Oldest, Largest and Most Experienced Predrainage Organization

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Chicago, Ill., Tampa, Fla., Houston, Tex., Hackensack, N. J.

sumption are outstanding features of the Model CL 34 Paving Breaker and Demolition Tool. All shaped parts are forged for extra strength and long life. Working parts are accurately machined. The highest possible hitting power is developed by a dependable throttle and air distribution system. A simple lever mechanism enables the operator to quickly change chisels and spades. **Engineered Equipment, Inc., CE-8, 1031 Linden St., Waterloo, Iowa.**

Corrosion Tests Reduce Refinery Costs

A SMALL PORTABLE METER has become a valuable tool in reducing depreciation costs at a Los Angeles refinery by determining corrosion inhibitor requirements in the diethanol amine (DEA) cycling stream, a neutralizing process for refinery and products.

Engineers first made use of the corrosion meter, known as the Corrosometer, in evaluating the effectiveness of different inhibitor compounds. The instrument's high sensitivity allowed them to detect changes in corrosion rates immediately. Similar tests were used to determine the optium dosage of the selected inhibitor.

With a Corrosometer "probe" in constant contact with the corrosive liquids in the DEA reboiler, operating personnel take corrosion measurements on a regular basis. When any corrosion is detected, the inhibitor is added. Used in this manner, the meter not only provides corrosion protection at all times, but eliminates over-addition of the inhibitor. **Crest Instrument Co., CE-8, Div. of Magna Products, Inc., 11808 S. Bloomfield Ave., Santa Fe Springs, Calif.**

Oversize Tire Spuds

A LINE OF OVERSIZE tire spuds, designed for use with a swivel stem that fits both tube and tubeless tires on off-the-road equipment, has been announced.

Designated SP-4000, the spud permits the use of tubes in tubeless tires and also simplifies inventories by eliminating a stock duplication of both tube and tubeless valve stems.

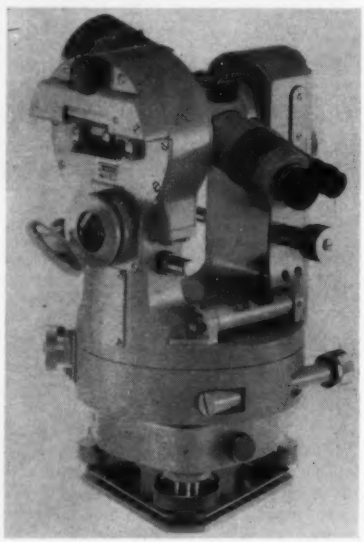
Tire mounting is easier and faster with the spud through the elimination of interference from an awkward stem. It also makes inflation and deflation as much as ten times faster.

A valve cap on the spud retains air pressure until the tire is needed; then a one-piece valve stem of correct length is attached to point in either direction. A separate extension is thus no longer required. **Dill Mfg. Co., CE-8, 700 E. 82nd St., Cleveland 3, Ohio.**

One-Second Theodolite

A NEW THEODOLITE READING directly to one second of arc, both vertically and horizontally, has been announced for the use of contractors, engineers and surveyors.

The circles are read directly by means of a micrometer and the angles can be estimated further, based on the experience of the observer, to from ½ to 1/10 of a second. The telescope transits at both ends. The lenses have an anti-reflection coating. Called the "Sethe",



The "Sethe"

the instrument is equipped with a quick setting and centering arrangement and is interchangeable in the leveling head with targets and subtense bar.

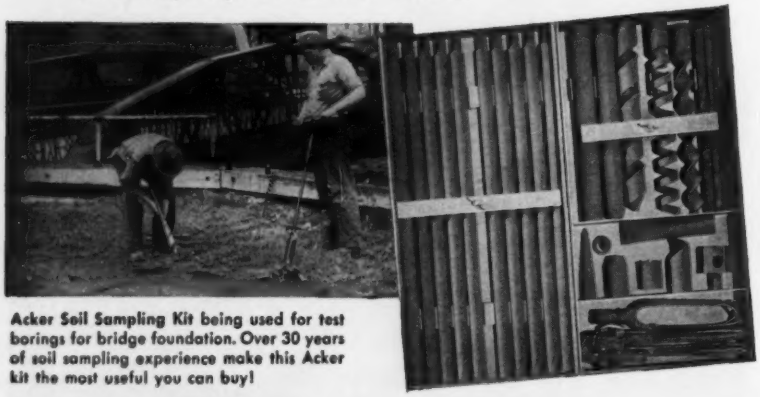
An optical plummet is built into the equipment and may be checked at any time by rotation. Accessories are available, such as illumination, compasses, plumb staff, eyepiece prisms, long diagonal eyepieces and filters. The instrument itself is carried in a shock-resistant, gasketed, water-proof case. **Fennel Instrument Corporation of America, CE-8, 50 Colfax Ave., Clifton, N. J.**

DON'T GUESS!

use an ACKER SOIL SAMPLING KIT for accurate sub-surface information

With accurate sub-soil information, *you avoid* costly trouble later on. And, what better way to get this information than with a portable, easy to use Acker Soil Sampling Kit. For here is a versatile collection of twelve soil sampling tools packed in a handy steel kit that can be carried in any car.

Write today for prices and Bulletin 26. CE



Acker Soil Sampling Kit being used for test borings for bridge foundation. Over 30 years of soil sampling experience make this Acker kit the most useful you can buy!

ACKER DRILL CO., Inc. P.O. Box 830 Scranton, Penna.

TIDE GATES

Figure B-175. Type M-R Gates designed especially for application to centrifugal pump discharge lines. A rubber seating ring is inserted in the seat to absorb the slap which occurs when pumps stop. A flexible bar connection is arranged between the hinge links to provide a stop for the gate shutter to prevent the outer edge of the shutter from tipping downwardly when flow abruptly ceases. Smaller sizes of gate are provided with a bumper arrangement to prevent the shutter being forced too widely open when flow starts.

Ask for Bulletin 73A

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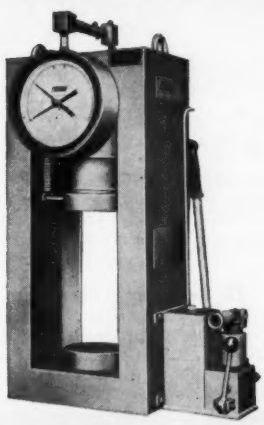
MODEL FT 20 JOBSITE CONCRETE TESTER



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TESTER DIVISION
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EQUIPMENT MATERIALS and METHODS

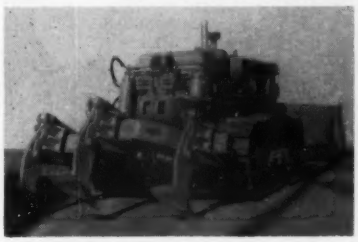
(continued)

Rock Ripper

DESIGNED SPECIFICALLY FOR Caterpillar D8 series H tractors, a heavy-duty tractor mounted rock ripper is now in production.

Available in two models, Model HR48-D8H has an off-set tool beam with ample clearance for mounting on tractors equipped with No. 29 Rear Cable Control and Model HR-D8H has the standard straight tool beam.

Both models will rip with one, two or three shanks to a maximum depth of 48



Heavy-Duty

in. Straight or curved shanks for 25 in., 42 in., or 48 in. ripping depths are available; the shanks are equipped with replaceable points.

Features include a "beefed-up" tool beam 11 in. x 12⅝ in. in section of 1½-in. plate all around, box welded and internally reinforced. Extra clearance under the tool beam (14 in. minimum when ripping) prevents clogging. Cylinders are 30% larger, with 40% heavier rods than previous D8 ripper models. **American Tractor Equipment Corp., CE-8, 9131 San Leandro Blvd., Oakland 3, Calif.**

Motorized Wheel

THIS NEW MOTORIZED WHEEL will provide earth movers used in pit mining and heavy construction with unmatched versatility, according to the manufacturer. The electric traction motor is included as an integral part of the wheel, eliminating transmissions, axles, and gearshifts, and requires power from a single direct-current generator driven by the vehicle's engine.

The wheel drive makes possible a 60-ton hauler combining high performance and large capacity with the maneuverability of a vehicle one third the size. The wheel provides safer, faster, stopping through the use of dynamic braking, in which the energy is dissipated as heat to bring the giant vehicle to a stop. **General Electric Co., Locomotive & Car Equipment Dept., CE-8, Erie, Pa.**

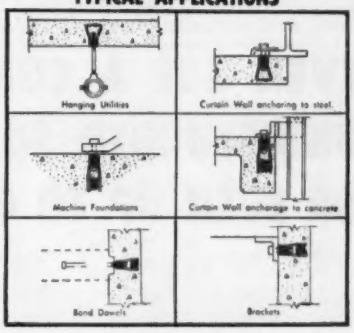
New Richmond Structural Concrete Inserts

With sufficient strength and safety for permanent fastening to concrete.

Available in ½" to 1½" diam. in strengths to 45,000 lbs. in 3,000 psi concrete

The *new* Richmond Structural Concrete Inserts are prefabricated from a special design which distributes the bolt stresses into the concrete for greater strength than any previously known device. Certified tests of these units in concrete at 3,000 p.s.i., verify this claim and permit design engineers to approach the problem of fastening appurtenances to structural concrete with greater security than has been possible in the past.

TYPICAL APPLICATIONS



The new Richmond Bulletin on Structural Concrete Inserts gives you complete information about these inserts and their varied uses. Send for it and the Richmond Handbook showing the full line of Tying Devices, Anchorages and Accessories for concrete construction. Write to:

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EVER SEE A CONTINUOUS TRULY UNDISTURBED SOIL SAMPLE 15, 30 OR EVEN UP TO 60 FEET IN LENGTH

In addition to being able to secure conventional type soil samples, Sprague & Henwood, Inc., also has available the Swedish Soil Sampler to recover undisturbed samples 15, 30 or even up to 60 feet in length. With this device, slide resistance and wall friction are almost eliminated and thin critical layers of soil that usually go unnoticed are easily detected.

Let us help you in solving your foundation testing problems. We have the equipment, personnel, and drilling "know-how" necessary to undertake your particular project. Our complete drilling service is illustrated and described in the new S&H Contract Brochure, write for your copy today.

A Sprague & Henwood crew recovering a 30 foot sample of sensitive marine clay.

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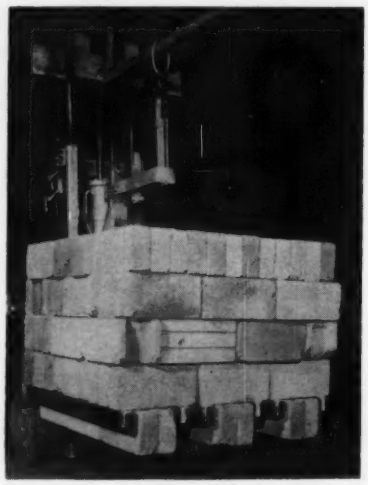
EQUIPMENT MATERIALS and METHODS

(continued)

Brick and Concrete Block Handling Unit

INCREASED PAYLOADS OF MORE than 1,000 lb per load are achieved with a newly developed aluminum brick and concrete block handling unit.

The loader and unloader can be used either on a lift truck or separately suspended from a crane. The necessity for pallets is eliminated by a hydraulic gripping device which holds the first tier securely, thus forming a platform for subsequent tiers.



Increased Payloads

All structural members of the unit are fabricated from aluminum supplied by Kaiser Aluminum & Chemical Sales, Inc. Except for the A frame which consists of two extruded channels of alloy 6061-T6, all structural members are of aluminum plate and heavy gauge sheet of alloy 5083. **Schmidgall Mfg. Co., CE-8, 307 Cass St., Peoria, Ill.**

Tie for Gang Forming

A NEW RE-USABLE tie designed specifically for gang forming with Symons panels has been introduced. Quick, positive disconnection of the tie through its double lead thread has led to faster erection and stripping of ganged sections in extensive field tests of the tie prior to its general introduction. The tie has a working load of 4,000 lb and an ultimate tensile strength of 6,000 lb. The outer unit of the tie is of one-piece construction and easily removed for re-use. **Williams Form Engineering Corp., CE-8, 1501 Madison Ave., S. E., Grand Rapids 7, Mich.**

EQUIPMENT MATERIALS and METHODS

(continued)

Saf-T-Jax

A NEW DEVICE WHICH permits faster and safer trench shoring on pipeline, sewer and other excavation jobs has been developed.

Called Saf-T-Jax, it is a strong integrally operated unit consisting of two opposing aluminum shoring members which are separated and supported by hydraulic jacks.

Complete units weigh less than most wood shoring timbers and are designed so that one workman standing at the top of the trench can easily install them directly behind the digger. They also are retracted from the top of the trench and fold together into units only 5¼ in. thick for handling and storage.

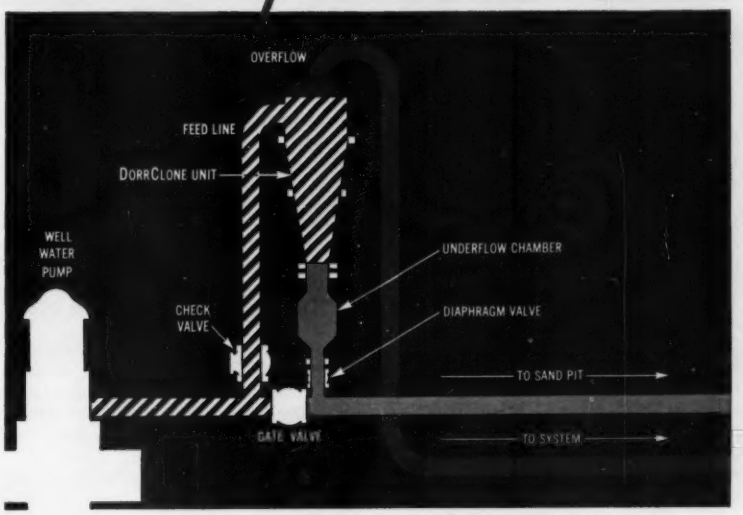
Two models, a unit with 2-ft long shoring pads and a 7-ft unit, are available. Both are equipped with 8-in. wide extruded aluminum alloy shoring members supplied by Kaiser Aluminum. **Sigma Engineering Corp., CE-8, 990 North Tenth St., San Jose, Calif.**

Plastic Insert

A RUBBER-LIKE plastic insert is now being installed into wet concrete which after the hardening of the concrete forms a weakened plane contraction joint, seals it and ties slabs together.

The installation is a simple one and the material buried in concrete does not deteriorate through weathering and is stable to freezing temperatures up to —55 deg F. **Edoco Technical Products, Inc., CE-8, 2370 E. Artesia Bl., Long Beach, Calif.**

It's NEW / It's from DORR-OLIVER



THE DORRCLONE
WELL WATER DESANDING SYSTEM

Continuous, positive removal of practically all undesirable sand and silt—without use of any power other than pressure supplied by the pump! That's what you get with the new DorrClone desanding system! It's today's simplest, lowest cost, most practical method of desanding well water—pays for itself over and over by reducing sanded mains, excessive wear and plugging of meters and abrasion of appliances.

Heart of the system is the DorrClone unit, a cylindroconical shell, shown diagrammatically above. In operation, raw feed water enters tangentially under pressure at the top. A vortex action is created, throwing sand particles to the walls of the cone and down to the underflow at the bottom. Sand-free water at the center of the vortex flows out the top to storage, a treatment plant, or directly to the mains.

Units may be designed to suit practically all well water systems. For full information, write for a copy of Bulletin No. 2507.

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(continued)

New Cranes

MAXIMUM STABILITY, EXTRA capacity with ease of operation, and a new high in lifting is combined in a new line of cranes.

Rubber mounted on a rugged carrier which has solid H-Beam frames, they feature ten-hole Budd, interchangeable disc wheels, air brakes, six wheel drive, 32,000-lb rear axle, 11-000-lb front axle. The 40,000-lb rubber mounted rear axle suspension requires no greasing.

Anti-friction bearings are used throughout and main bearings are 8 times greater than the strength required. Clutch band engaging arms ride on pre-packed needle bearings.

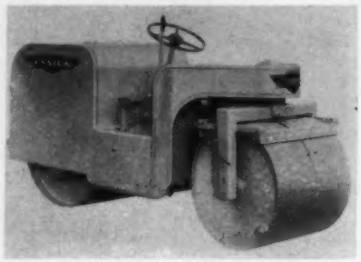
The increased stability of the cranes is assured at all working angles by double oscillating conical rollers of heat-treated alloy steel.

Simplicity of design is evident in the single main shaft to eliminate extra bearings and clutches; all wheels are interchangeable so only one spare is required; pin-connected boom permits rapid erection; and there is a minimum of working parts for lower maintenance costs and less down-time. **Hardwicke-Etter Co., CE-8, Sherman, Texas**

New Roller

REDESIGNED AND ENGINEERED from the ground up, the model 310 Roller replaces the previous model 300, three ton tandem roller. It features a lower profile, wider rolls, new steering arrangement and a specially designed transmission and clutch, these innovations producing the best stability and visibility due primarily to the lower center of gravity and the lower over-all height.

Tough, heavy-duty construction ensures long life and superior performance. Equipped with the largest diameter guide roll of any comparable roller, the 310 produces perfect surfaces as it rolls on top of, rather than pushing forward, the soil or asphalt. The electrically welded steel plate yoke, a tough and rugged integral part, is another example of the use of extra heavy-duty construction where it counts.



The roller is designed especially for the contractor who needs 3 tons of compaction combined with a unit of tough heavy duty construction, great stability, portability, maneuverability and maximum visibility. **Essick Manufacturing Co., CE-8, 1950 Santa Fe Ave., Los Angeles 21, Calif.**

Wall Thickness Bushing

DEVELOPMENT OF A NEW, revolutionary adjustable wall thickness bushing permitting radial dimensions to be easily and exactly varied by a simple mechanical adjustment has been announced.

Consisting of a series of alternate male and female segments aligned axially, the application of an axial compressive force to the ends of the bushing causes the male segments to assume a smaller diameter, thus reducing the I.D. of the bushing, while at the same caus-

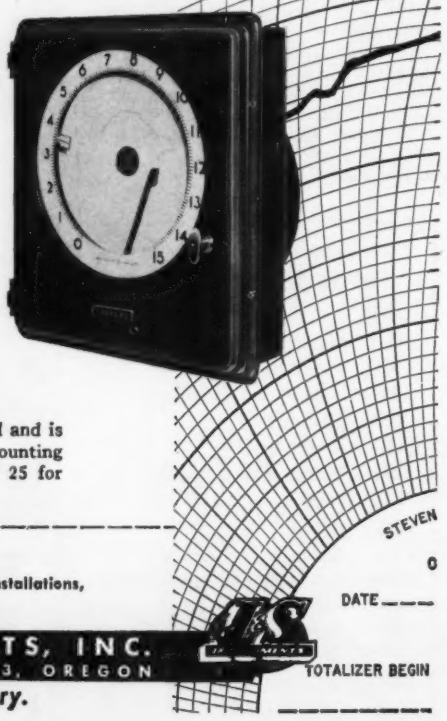
(Continued on page 131)

ACCURATE GRAPHIC AND VISUAL REGISTRATION

of liquid flow with

STEVENS

RECORDER TYPE B-FT



Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears... an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.

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EQUIPMENT MATERIALS and METHODS

(continued)

ing the female segments to assume a larger diameter, thus increasing the O.D. of the bushing. All segments are slit axially through one wall to provide ease of adjustment.

This simultaneous decrease in I.D. and increase in O.D. results in a thicker wall for the bushing providing a convenient and low-cost method of maintaining an exacting fit without expensive machining usually associated with good radial fits. **Globe Bushing Corp., CE-8, 12036 Vose St., North Hollywood, Calif.**

Tandem-Axle Construction Trucks

A COMPLETE NEW LINE of tandem-axle construction trucks, custom engineered to provide maximum payload and durability in every ready-mix concrete and materials-hauling operation, is now available.

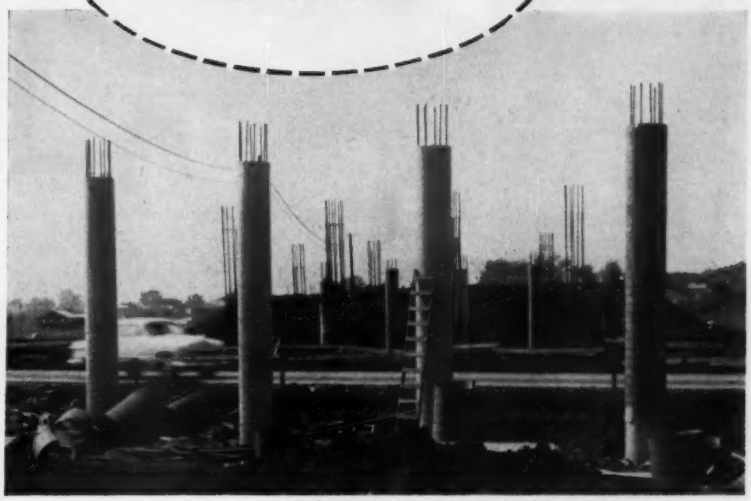
The new construction trucks, for use with dump bodies, dump trailers, concrete mixers, flatbed bodies, and other specialized operations, are offered in four model designations, both gas and diesel, from 35,000 to 75,000 lb GVW. A wide range of component options permits tailoring the chassis, engine, transmission,

and axle combinations of each model to the exact requirements of the operator.

All models are built with simplified radiator and fender assembly. The radiator core can be removed quickly by unbolting the front grille, and without removing the radiator shell. The bumper and a front fender can be removed in just five minutes so the mechanic can stand between an out-turned front wheel and the engine compartment for fast, efficient work under the hood.

The same wider-tread front axle feature which aids this easy access to engine also permits shorter turning radii and with the short dimension from center-line of the front axle to the back of the cab, allows more chassis and payload weight to be shifted from the rear to the front axle on the trucks. **The White Motor Co., CE-8, 842 E. 79th St., Cleveland 1, Ohio.**

Fibre Forms Cut Costs of Round Concrete Columns



Highway overpass on U.S. 50, Johnson County, Kansas. Designer: Kansas State Highway Commission. Contractor: Swenson Construction Company.

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FIBRE FORMS

Because they are lightweight, easy to handle and place, strip quicker, and require only minimum bracing, Sonoco SONOTUBE Fibre Forms save time, labor and money—provide the fastest, most economical means of forming round columns of concrete.

The overpass piers shown above are 20 feet high, and were formed with 30" and 36" I.D. SONOTUBE Fibre Forms.

For buildings, bridges, overpasses, schools, churches—in fact, whenever round concrete columns are specified—use SONOTUBE Fibre Forms. Approved by architects and engineers and used successfully by contractors everywhere, there's no better way to cut costs!

Choose from 3 types: Seamless (premium form for finished columns); "A" Coated (standard form for exposed columns); or "W" Coated (for unexposed columns).

Order Sonoco SONOTUBE Fibre Forms in required lengths or standard 18' shipping lengths . . . sizes available from 2" to 48" I.D.

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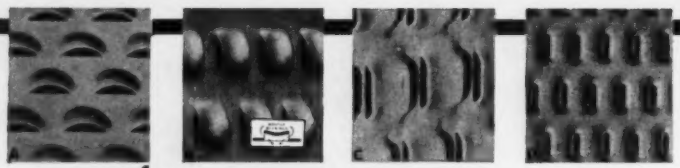

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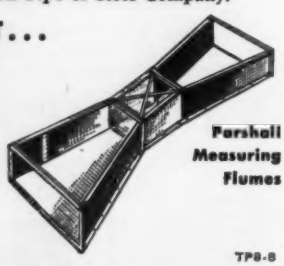
The finest well is only as efficient as its casing. Today you can put down casing designed to meet your exact requirements...based on formation, soil analysis, water levels, seasonal conditions, etc.

Thompson Pipe & Steel makes well casing of all kinds and sizes...from 4" to 36" diameters, black or hot dipped galvanized mild steel, STAINLESS, Monel, Everdur and nonferrous metals. A variety of perforations and field joints to choose from. Get the *right* casing from Thompson Pipe & Steel Company.

2. ACCURATE MEASUREMENT...

THE PARSHALL FLUME measures fast or slow moving water accurately, easily read from a standing position, no recalibration required for self cleaning, easy to install, maintenance free, lasts for years. Approved by State Engineers; eliminates disputes over water measurement. This simple, efficient, low cost flume available from our large stock; 3" to 36" throat widths. Larger sizes made to order.



Parshall Measuring Flumes

TPS-8

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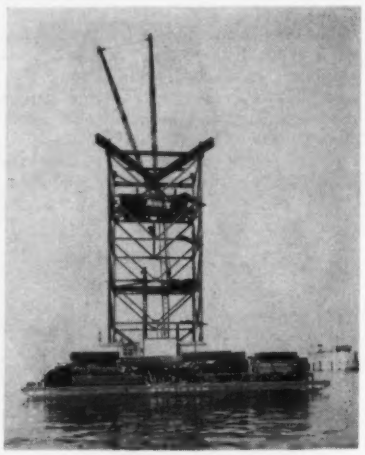
EQUIPMENT MATERIALS and METHODS

(continued)

Floating Tower Derrick

ERECTION OF THIS HUGH floating tower derrick just south of the Fort Schuyler shoreline means that erection crews have started constructing the first of the twin 326-ft steel towers that will support the main span of the $90,000,000 Throgs Neck Bridge, a six-lane link between the Bronx and Queens. With its approaches, the bridge will have a total length of more than two miles (12,310 ft). It is scheduled for completion in 1961.

When the floating tower derrick is completed, it will have an upward reach of 240 ft and a lifting capacity of 80 tons. The tower base for the derrick straddles two steel barges and alone has a height equivalent to that of a 12-story building. Because the Bronx-Whitestone



80-Ton Lifting Capacity

Bridge has a water clearance of only 137 ft, the derrick had to be constructed in two stages. The initial stage, consisting of the building of the 120-ft base, was completed at Hunts Point and towed under the Bronx-Whitestone Bridge to a point 500 ft south of the Throgs Neck peninsula where concrete foundation work for the first bridge tower has been completed. A guy derrick built within the framework of the tower is now "jumping" the stiff legs, mast and 120-ft boom of the derrick to the top of the tower for assembling. Four anchors, each weighing four tons, will hold the floating derrick in place during construction of the bridge towers. **Bethlehem Steel Co., CE-8, 25 Broadway, New York 4, N. Y.**

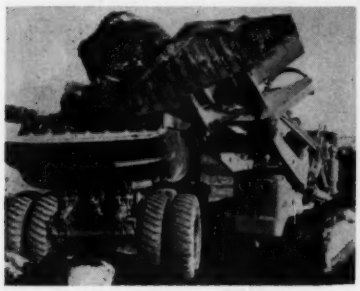
EQUIPMENT MATERIALS and METHODS

(continued)

Side-Tipping Bucket

A SWEDISH INVENTION, the Libu side-tipping bucket, not only substantially boosts loader capacity and cuts loading costs generally, but also makes it possible to employ mechanical loading in spaces so confined that conventional loaders cannot be economically used for lack of elbow room.

The bucket differs from the conventional loaders in that it can be tilted as desired to the right or left as well as forward. This side-tipping function is based on the principle of the open-sided bucket swivelling about a central pivot. It could be said that the bucket is a



Boosts Loader Capacity

giant mechanized version of the age-old hand spade, which is also open-sided and is rotated by the hand about the handle. The Libu bucket, which takes a load of up to 1½ cu metres and will lift boulders of 6 or 7 tons, is tilted laterally by hydraulics. The outstanding digging ability and the forward tipping are also attained by hydraulic means.

The bucket is dimensioned in all respects to stand up to the hardest work, the loading of blasted rock, including effective digging into such material. Ribs and digger edges are made of highest-grade Swedish manganese-steel and the whole bucket is so solidly built that it will last for a long time. **Libu Shovel Co. AB, CE-8, Stocksund, Stockholm, Sweden.**

Single-Stage Rotary Compressor

ECONOMY OF OPERATION and maintenance are said to be the outstanding characteristics of the new 85-ft Super Blue Brute single-stage, portable air compressor. The unit combines single-stage simplicity with two-stage economy because both its engine and compressor reach peak efficiency at only 1800 rpm, a substantially lower operating speed than any other portable compressor now available. Lower speed op-

(Continued on page 134)

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EQUIPMENT MATERIALS and METHODS

(continued)

eration also reduces wear, and engine life is further extended by a clutch which permits warm-up without load.

The unit has discharge pressure settings of from 75 to 125 psi. Designed for heavy duty operation, it need not be level but will perform satisfactorily on moderate slopes.

Wide-track wheels, corresponding to those of most trucks, and a lower center of gravity permit safe towing at high-speeds, even over rough, rutted terrain. The air compressor also has full-length tool boxes providing maximum storage space. **Worthington Corp., Holyoke Div., CE-8, Holyoke, Mass.**

Six-Wheel Scraper

A FAST, HIGH-PRODUCTION six-wheel self-propelled scraper has been introduced. Named the Model C Speedpull, the machine teams a 20-yd heaped-capacity Fullpak scraper with a 276-hp 4-wheel prime mover.

Major operating advantages are expected to result from the Speedpull's excellent horsepower-to-weight ratio of only 336 lb of total loaded weight per horsepower. It is reported that the machine's low-friction drive train, especially designed transmission, and ducted fan will permit an exceptionally high percentage of engine horsepower to be delivered to the drive wheels.

Hydrair Suspension

Probably the most unusual design feature of the scraper-prime-mover combination is Hydrair suspension of its front wheels. In this system, each front wheel is mounted to a piston which operates inside a frame-mounted cylinder. Surrounding the piston is a circular chamber of oil, connected by tube to an oil reservoir inside the piston. As the wheel rolls along surface irregularities, the up-and-down motion of the piston forces oil in and out of the piston's reservoir. This in turn, compresses and decompresses nitrogen gas contained above the oil reservoir, snubbing the overall movement of the piston and wheel, thus absorbing shocks and leveling the ride. **LeTourneau-Westinghouse Co., CE-8, 2301 NE Adams St., Peoria, Ill.**

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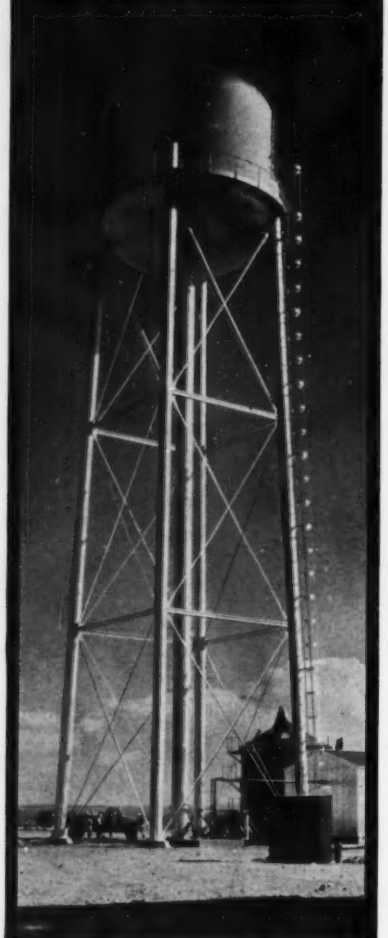

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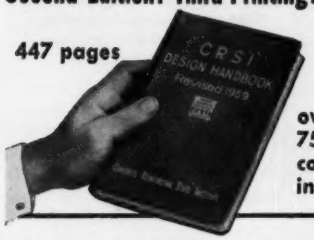

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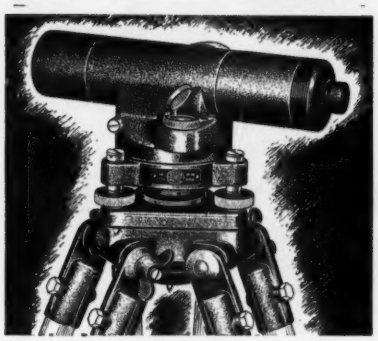

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LIQUID LEVEL AND FLOW CONTROL—A wealth of information on how to provide operating and safety controls for a wide variety of jobs involving liquid level and liquid flow is contained in Bulletin ERS-A. This 24-page bulletin shows how float-operated valves and switches and flow switches offer industry an economical and dependable solution for many other frequently-encountered control problems. Typical applications range from water supply to proportioning systems; from stand-by pumps to unit ventilators; from hydropneumatic tanks to water chillers. There are 21 case studies in all. **McDonnell & Miller, Inc., CE-8, 3500 N. Spaulding Ave., Chicago 18, Ill.**

DIAMOND SPAN-R BEAM—A new, unique, patented structural beam is described in a 6-page folder. Said to be lighter than conventional beams and lower in cost than fabricated joists, the beam is designed to support floors and roofs over spans up to 90-ft between beams, walls and girders. It is recommended for use in all types of structures, including schools, factories, warehouses, stanchions, cantilever construction and ship decks. The brochure includes specifications and a properties and uniform loads chart. **Elizabeth Iron Works, Inc., CE-8, Box 360, Elizabeth, New Jersey.**

HEAVY DUTY SCREENS—Among the several improvements made recently to the Mesabi screen line which are described in this 16-page brochure is the addition of secondary spring type of screen suspension which, it is said, eliminates transfer of vibration to supporting structure, increases screen efficiency and reduces strain on screen assemblies. Illustrations of this new type screen suspension on both portable plant-mounted screens and stationary installation screens are shown. **Pioneer Engineering, Div. of Poor & Co., CE-8, 3200 Como Ave., Minneapolis, Minn.**

HORIZONTAL SHORING—Included in this 8-page illustrated booklet is a description of the horizontal shoring, a loading table, and typical installations. Also available is a catalog which explains in detail how to organize the erection and stripping of the horizontal shoring and how to deal with certain job conditions. **American Pecco Corp., CE-8, Federal Savings Bldg., 188 East Post Road, White Plains, N. Y.**

PLASTICS CATALOG—An unusual Plastics Catalog lists more than a dozen materials available from warehouses. It gives sizes and colors stocked in rods, strips and sheets. For many of the materials, properties needed for engineering design are given with a brief statement of the effect on the different materials of sun, acids, alkalies and heat. **Cadillac Plastic & Chemical Co., CE-8, 15111 Second Ave., Detroit 3, Mich.**

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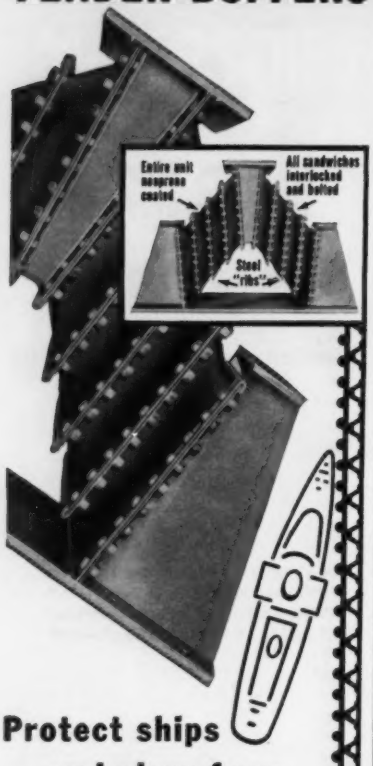

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Literature Available

CONSTRUCTION MACHINERY—Catalog MS-1312 gives engineering features and operating advantages of the TS-260 motor scraper powered by the new 16000 diesel engine developing 230 hp. Pictures of the scraper, its power plant, power train and many of the important components help readers visualize the machine's features. Also available is catalog MS-1351 which covers the HD-6 diesel powered crawler tractor. Pictures, graphs, charts and other illustrations graphically bring up-to-the-minute information about the unit to the reader. **Allis-Chalmers Mfg. Co., CE-8, 864 S. 70th St., Milwaukee, Wis.**

ALUMINUM WELDING—A comprehensive survey of the techniques of welding aluminum using Aircomatic (gas-shielded metal-arc) and Heliweld (tungsten-inert-gas) processes has been issued. This 120-page spiral bound book, entitled "Aircomatic & Heliwelding of Aluminum", thoroughly covers the entire subject from a brief historical note on the first uses of these processes for welding aluminum to the highly specialized aluminum fabrications which are being welded with them today. Major topics covered include: weldability of aluminum and its alloys, definitions and technical discussions of the two welding processes, selection of the proper process for certain job applications, descriptions of manual and automatic equipment, welding power supplies, and safety practices. **Air Reduction Sales Co., CE-8, 150 E. 42nd St., New York 17, N. Y.**

PRECAST CONCRETE FLOORS—A new 6-page brochure describes how the Port Columbus Airport in Columbus, Ohio, used precast concrete floor and roof units in their main terminal building to provide maximum fire safety and electrical flexibility. Photographs and detail drawings illustrate how separate sets of the hollow cells in the concrete slabs were used as raceways for three complete underfloor signal, electrical and telephone distribution systems. Additional data explains the flexibility of the power system; how new power floor outlets may be installed as needed and old ones abandoned. **Flexicore Co., Inc., CE-8, 1932 E. Monument Ave., Dayton 1, Ohio.**

MONOTUBE PILES—A comprehensive 24 page catalog covering Monotube fluted steel foundation piles has been released. In addition to complete descriptive information, the new catalog includes typical installation photos, test driving data, and other technical information of particular interest to engineers, contractors and architects. **The Union Metal Mfg. Co., CE-8, 1400 Maple Ave., NE, Canton 5, Ohio.**

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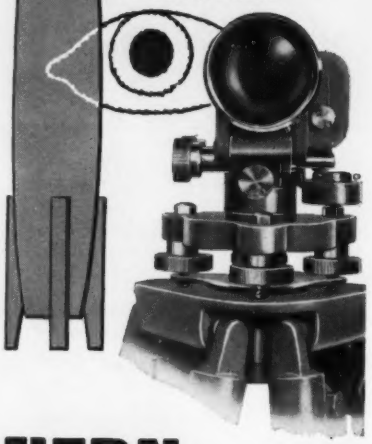

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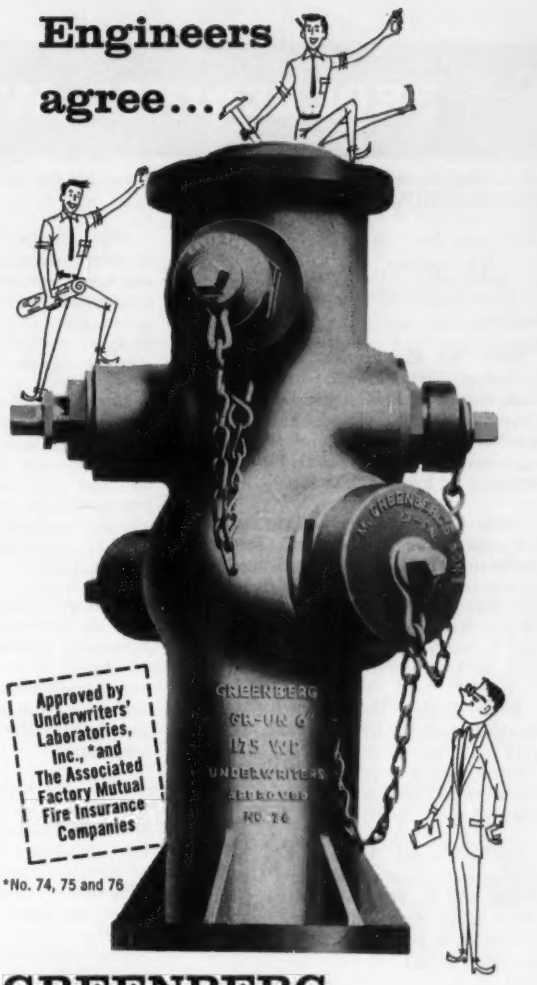
From the MANUFACTURERS

AWARDED CONTRACT: As part of an expansion program, Tappan Stove Co., Mansfield, Ohio, has awarded a contract to The R. C. Mahon Co.'s Industrial Equipment Division, Detroit, to design and manufacture a completely integrated automatic paint finishing system for domestic stove parts, without sacrificing or extending plant floor production area . . . **SUBSIDIARY ESTABLISHED:** Hewitt-Robin, Inc., announced the establishment of a new wholly-owned subsidiary in Italy to provide better service and more complete market coverage for Hewitt-Robins conveyor machinery, conveyor belting, vibrating screens, power transmission equipment and industrial rubber products . . . **DISTRIBUTOR APPOINTED:** Piping Products, Inc., Moorestown, N. J., has been appointed a distributor of Reynolds aluminum pipe products, Reynolds Metals Co. . . . Road Equipment Co., Inc., New Orleans, La., is a new distributor for Highway Equipment Co., Cedar Rapids, Iowa. They will handle the Hi-Way line of ice control and bituminous paving equipment . . . **NEW OFFICE:** The Henry Pratt Co., formerly of 2222 S. Halsted St., Chicago, has moved its main office to 319 W. Van Buren St., Chicago . . . **RESEARCH CENTER:** Plans for construction of a modern Research Center on a 12-acre landscaped site in Solon, Ohio, have been made by The Warner & Swasey Co., Cleveland . . . **BEGINS ALUMINUM CONDUIT PRODUCTION:** Pittsburgh Standard Conduit Co. has announced its entry into the production and distribution of aluminum rigid electrical conduit, which will be processed from raw piping supplied under an exclusive agreement with Olin Matheison Chemical Corp. . . . **NEW COMPANY:** Southwest Wire Products Corp., Dallas, Texas, has been formed to manufacture concrete reinforcement wire . . . **HOME STUDY COURSES AVAILABLE:** A new home study training program for diesel mechanics is now available. Cummins Engine Co. has authorized Interstate Training Service of Portland, Ore. to provide two courses for Cummins diesel mechanics and employees, and for non-employees as well . . . **NEW BRANCH:** A new Long Island City branch has been opened by Brunner & Lay-Eastern, Inc. at 43-11 Eleventh St. It will carry a complete line of air tool accessories and blast hole rock drilling tools . . . **DEFENSE PRODUCTS DEPARTMENT:** A new department—Defense Products—has been formed by Caterpillar Tractor Co., Peoria, Ill., to participate more vigorously in the huge national defense program our country is obligated to undertake . . . **PLANT RECEIVES HONOR:** The Charles Bruning plant at Mt. Prospect, Ill., has been selected by Factory magazine as one of the top ten plants constructed throughout the country in 1958 . . . **REALIGNS SALES ORGANIZATION:** Due to its rapid growth and accompanying attemps to keep its sales department facilities apace with this expansion, Disogrin Industries recently announced the creation of two separate and distinct sales divisions—Disowheel Div. and Disogrin Products Div. . . . **MERGER ANNOUNCED:** Marietta Concrete Corp. has announced the merger of its business and operations with American-Marietta Co., one of the nation's largest producers of construction materials . . . **CONSOLIDATION ANNOUNCED:** The consolidation of the Van Norman Machine Tool Co. and Van Norman Automotive Equipment divisions of Van Norman Industries into one firm to be known as Van Norman Machine Co. has been announced . . . **APPOINTMENTS:** Bonham M. Fox has been named Sales Manager for Eugene Dietzgen Co., Chicago, Ill. . . . The appointment of S. Tucker Gay, Jr., as Assistant District Sales Manager for Laclede Steel Co. in Chicago has been announced . . . Grant Photo Products Inc., announces that James O. Calvert has been named Sales Manager of the Eastern District from Main to Virginia, and John W. Matthews has been appointed Sa'es Manager of the Central District from Michigan to Florida. **ARMY ENGINEER SCHOOL AWARD:** Harald T. Reisus, Const. Equip. Div. Vice-Pres. of International Harvester Co., has received the plaque of the U. S. Army Engineer School, Ft. Belvoir, Va., for his outstanding contribution to the training programs of the school.



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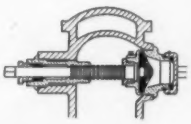

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Journals: Air Transport, Engineering Mechanics, Hydraulics, Sanitary Engineering.

2079. An Engineering Appraisal of Hydrologic Data: Progress Report of the Task Group of Hydrologic Data of the Committee on Hydrology of the Hydraulics Division. (HY) A brief chronology is given of studies made since 1936 on the adequacy of hydrologic data.

2080. Ground Water Utilization, Suffolk County, L. I., New York, by J. F. Hoffman. (HY) Water problems that may arise through constantly increasing withdrawals include extensive sea water encroachment, marked depletion of storage, industrial contamination, and rises in water temperatures.

2081. Design Methods for Flow in Rough Conduits, by Henry M. Morris. (HY) Design curves and methods are presented for determining friction factors for turbulent flow in closed conduits and tranquil open channel flow.

2082. Ground Water Flow in the Netherlands Coastal Dunes, by David K. Todd, and L. Huisman. (HY) Ground water distribution and flow in part of the Netherlands coastal dunes are analyzed mathematically.

2083. A Time Interval Distribution for Excessive Rainfall, by H. C. S. Thom. (HY) Although recurrence intervals are of primary interest in frequency analysis of excessive precipitation, present methods average these intervals and thus conceal much design information.

2084. Determination of Hydrologic Frequency Factor, by Ven Te Chow. (HY) A graphical method for the determination of the frequency factor in a log-normal distribution of hydrologic data is described. The graphical procedure is simpler than the analytical method and it produces results with less effort.

2085. Roll Waves and Slug Flows in Inclined Open Channels, by Paul G. Mayer. (HY) Roll waves and slug flows, two distinctly different wave patterns, are studied phenomenologically in an inclined open channel.

2086. Pilot Plants for Water Treatment Research, by Gordon G. Robeck and Richard L. Woodward. (SA) The paper outlines the facilities of pilot plants at the Robert A. Taft Engineering Center and reviews the present and proposed studies.

2087. Sludge Treatment and Disposal by the Zimmerman Process, by the Sewage Treatment Section of SED Research Committee. (SA) The data recently published, give the results of a pilot plant study of the Zimmerman Process for destroying organic sludge solids.

2088. Dust Properties and Dust Collection, by B. Gutterman and W. E. Ranz. (SA) Basic research of the physical properties of dust in suspensions and dust layers related to dust collection has resulted in the development of analytical methods which permit calculation of re-entrainment and backmixing characteristics.

2089. A 7-Mile Digested Sludge Outfall, by Norman B. Hume, Robert D. Bargman, Charles G. Gunnerson and Charles E. Imel. (SA) Engineering and oceanographic factors which established the design and construction criteria for Los Angeles' digested sludge outfall are reviewed.

2090. Absorption of Oxygen From Air Bubbles in Water, by W. Wesley Eckenfelder, Jr. (SA) Several correlations have been developed to define the absorption of oxygen from gas bubbles in water. This paper develops relationships between the liquid film coefficient, K_L and the Reynolds and Schmidt Numbers at liquid submergence depths up to 15 ft. Correlations are also developed relating the overall coefficient, K_La, to pertinent process variables.

2091. Commentary on Plastic Design in Steel: Basic Concepts. Progress Report No. 1 of the Joint WRC-ASCE Committee on Plasticity Related to Design. (EM) This paper is the first of a series issued by the Committee. It documents the applicability of plastic analysis to design of structural steel beams and frames.

2092. Commentary on Plastic Design in Steel: General Provision and Experimental Verification. Progress Report No. 2 of the Committee on Plasticity Related to Design. (EM) This paper is the second in a series of reports on plastic design emanating from the Committee. Some of the basic considerations that should be satisfied in establishing a plastic design procedure are presented. Provisions are suggested for such questions as types of construction, material properties, and the load factor.

2093. Stratified Flow into a Line Sink, by Walter R. Debler. (EM) The discharge of a stratified fluid (with a stable linear density variation at infinity) through a horizontal slot at the end of a channel has been experimentally investigated. The experiments show that when the densimetric Froude number is less than 0.28 the flow pattern is divided into two horizontal regions.

2094. A Method of Computation for Structural Dynamics, by Nathan A. Newmark. (EM) This paper describes a general procedure for the solution of problems in structural dynamics. The method can be applied to structures of any degree of complication, with any relationship between force and displacement ranging from linear elastic behavior through various degrees of inelastic behavior or plastic response, up to failure.

2095. Ultimate Strength Criteria for Reinforced Concrete, by Ladislav B. Kriz. (EM) Criteria for ultimate strength of structural members are derived by determining analytically the value of extreme compression edge strain which results in maximum moment or load.

2096. Shrinkage, Swelling and Creep in Cement, by A. Hrennikoff. (EM) Study of the shrinkage-swelling phe-

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2097. Discussion of Proceedings Paper 1582, 1901, 1935, 1962. (HY) Martin E. Nelson and Harvey J. Johnson, closure to 1582. J. R. Bocoman on 1901. E. Pariset and B. Michel on 1935. Peter Ackers on 1962.

2098. Discussion of Proceedings Papers 1678, 1717, 1848, 1852, 1854, 1930, 1984. (SA) Committee closure to 1678. J. F. Laboon closure to 1717. Nadavia Bethlahmy closure to 1848. C. A. Gordon closure to 1852. James S. Hoffman correction to discussion of 1854. P. Dejonghe, Pierre Cohen on 1930. L. Tholin and Clint Keifer corrections to 1984.

2099. Discussion of Proceedings Papers 1792, 1898. (EM) Theodore R. Higgins, on 1792. Richard E. Mason, Gordon P. Fisher, and George Winter closure to 1792. Enzo Oscar Macagno on 1898.

2100. A Statement of Objective, by Reginald J. Sutherland. (AT) This conference is an attempt to draw on the experiences gained in operating the new jet aircraft.

2101. The Role of the Air Transport Division, by John N. Kyle, Jr. (AT) The Air Transport Division organized in 1945 functions as a clearing house for information on air transport facilities.

2102. VTOL-STOL Aircraft Progress Report of the Committee on Air Centers of the Air Transport Division. (AT) The physical dimensions of the aircraft that will utilize the urban air centers of the future are of major interest to city planners and designers.

2103. Aircraft of the Future and Ports for Modern Flight Vehicles, by Charles S. Draper. (AT) Flight vehicles covering the broad spectrum of aeronautical and astronautical types are reviewed.

2104. Aircraft Fueling Systems for Jets, by James P. O'Donnell. (AT) This paper considers general design criteria for civil airport fueling systems for pressured fueling of jet aircraft.

2105. The Pattern of Future Air Travel Demands, by J. W. Pocock. (AT) There is a need for modernizing primary airports and constructing 3,000 additional secondary airports to accomodate air carrier and general aviation fleet growth anticipated in the next decade.

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2110. Auto Parking for Efficiency and Revenue at Airports, by Ben E. Nunn. (AT) A study is presented of parking facilities and economics at jet-age airports.

2111. The Future of Airline Ground Transportation, by William J. Culbirth, Jr. (AT) The capable ground operator currently operating the surface transportation at our various Airports is a "key" man to the success of the jet age.

2112. Airport Revenue Bond Financing, by Walter C. Cleave. (AT) To reduce financing costs and encourage efficient operation, it has been suggested that airports owned by a city or other public body be combined into a single airport system.

2113. An Operator's Experience in Airport Operations with Jets, by R. J. Sutherland. (AT) This paper outlines experiences at various airports during the initial four months of operation with Boeing 707-123 model jet air transports.

2114. Experience in Airport Operations with Jet Aircraft, by Peter W. Ball. (AT) BOAC has successfully operated Jet and Turbo-Prop Aircraft with little difficulty or inconvenience to others.

2115. Experiences in Air Terminal Operations with Jet Aircraft, by Randall W. Kirk. (AT) Air terminal operating experience during the first seven months of Boeing 707 is recounted with specific reference to Idlewild (New York), Le Bourget (Paris), Ciampino (Rome), and London Airport-North (England). Criteria are included for design of the ideal airport terminal.

2116. Airline Experience in Airport Operation with Jet Aircraft, by Marci B. Fannon. (AT) One important facet of jet integration concerns interim facilities until planned terminals and facilities become available. Improvements in general airport arrangement—ramp layout, passenger handling facilities, airplane servicing and over-all operation—all assist in providing faster, more efficient ground handling, with improved service and comfort for the passenger.

2117. The Development of Design Criteria for Washington International Airport Terminal Facilities, by Richard M. Huber. (AT) Design concepts, Progress Report, and special features for aircraft and passenger handling are being incorporated in the New Washington International Airport under construction near Chantilly, Virginia.

2118. Development of Rigid Pavement Design Criteria for Military Airfields, by James P. Sale and Ronald L. Hutchinson. (AT) Results of Corps of Engineers' rigid airfield pavement investigations since 1940 are related to the continuing changes in requirements dictated by military aircraft growth and increasingly severe ground operational characteristics. Traffic test data is integrated into usable design and construction criteria.

2119. Prestressed Concrete Pavements, by Eric C. Molke. (AT) Deflections and bending moments for beam and slab on elastic foundation are reviewed for the elastic as well as the plastic range. Advantages of working in the plastic range for slab moments confirm the usefulness of prestressing to harmlessly close small haircracks.

2120. Effects of Jet Fuel Spillage and Blast on Pavements, by H. J. Lichtefeld. (AT) This paper reviews the problems associated with jet fuel spillage, heat and blast created by the operation of turbine-powered aircraft as related to civil airport pavements. The material is compiled from information obtained from the military, aircraft manufacturers, and aircraft engine manufacturers, as well as from observations at several civil airports.

2121. Runway Lighting—New York International Airport, by John P. Veerling. (AT) A description is given of lighting under construction for a new instrument runway.

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2123. The Airport Operator in the Jet Age, by E. Thomas Burnard. (AT) Capital financing, master planning, keeping abreast of technological developments in aviation and achieving financial self-sufficiency are among the key problems of airport operators in the Jet Age.

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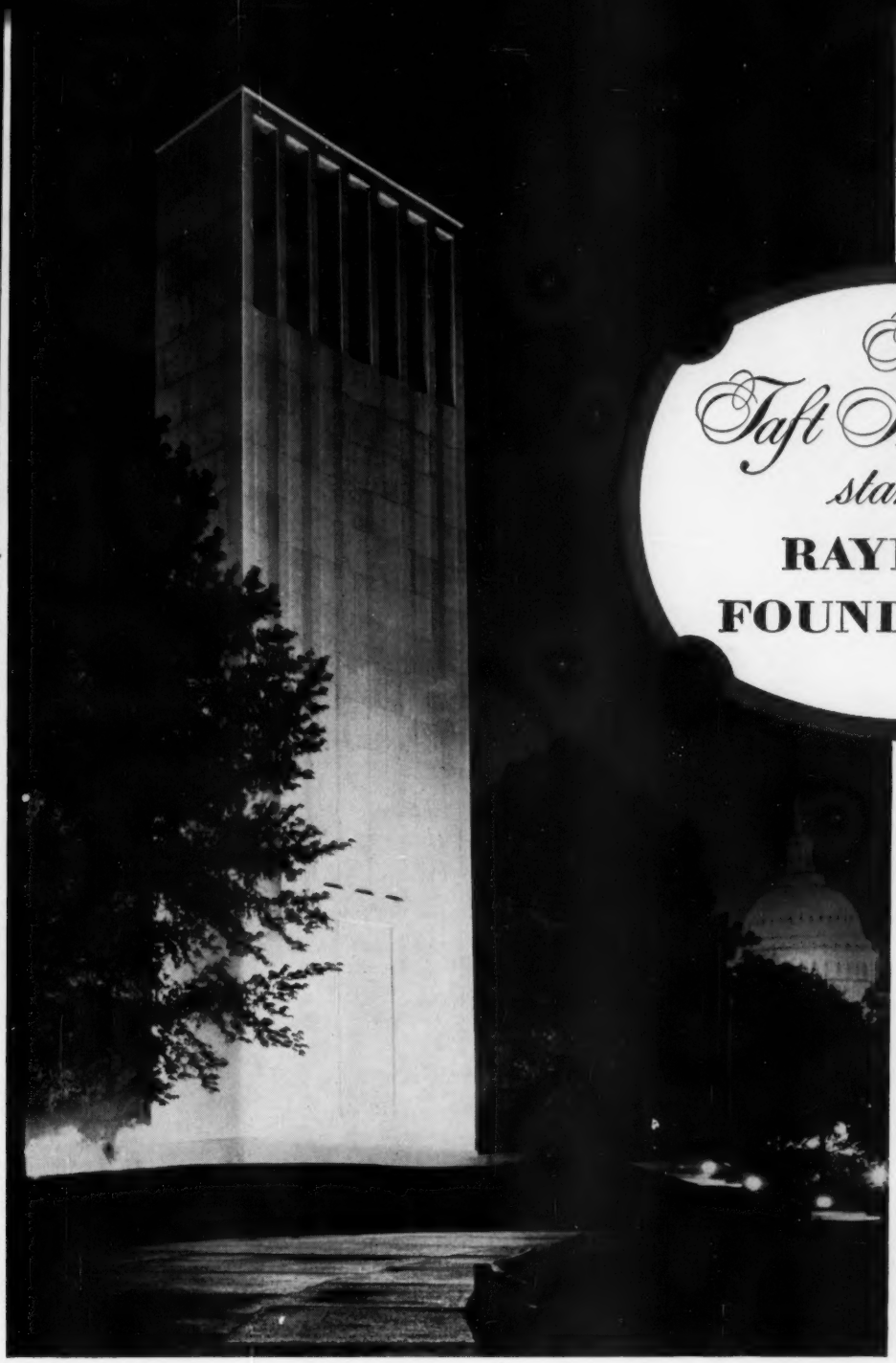

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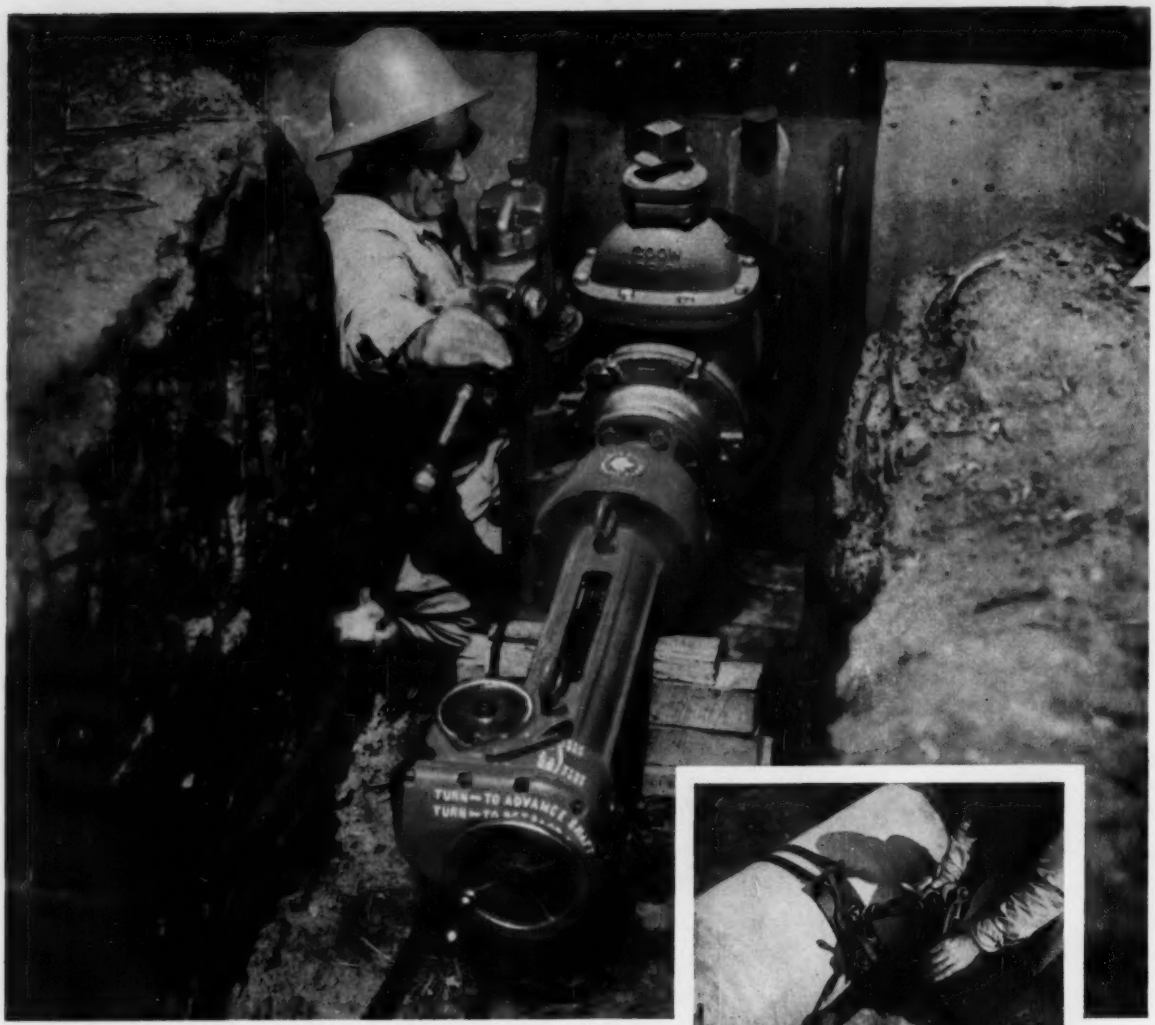

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